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ONTARIO
DEPARTMENT OF EDUCATION

REPORT

ON

AN EXPERIMENT

IN

EDUCATIONAL MEASUREMENT

AUTHORIZED BY THE MINISTER OF EDUCATION

A COMPARISON BETWEEN NEW TYPE AND OLD TYPE EXAMINATIONS
AND A DETERMINATION OF THEIR RELIABILITY AND VALIDITY

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1931

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NOTE

THIS REPORT WAS WRITTEN BY PROFESSOR H. E. FORD, M.A., Ph.D., OF VICTORIA COLLEGE, UNIVERSITY OF TORONTO, WHO SUPERVISED THE STATISTICAL WORK INVOLVED IN THE EXPERIMENT.

REPORT

on an

EXPERIMENT IN EDUCATIONAL MEASUREMENT

I

INTRODUCTION

The Education Department of the Province of Ontario has during recent years been increasingly interested in new developments in the field of educational measurement. Part of this interest has doubtless been due to the work of the Canadian Committee on Modern Languages and to the extensive testing campaign carried out by this committee. Many teachers throughout Ontario owed their first experience with standardized tests to the work of this committee.

During the last few years the volume of the Matriculation examinations has grown so rapidly that the burden on the Department, even aside from all budgetary considerations, has become formidable. Thus the feeling has grown that some change must be made in the examination system to meet the many objections that were being raised from time to time against it.

On the 10th of December, 1928, an informal meeting was held to consider the new-type examination and to determine whether this new form could be of any value in connection with the departmental examinations. At this meeting were present the supervising board of examiners, deans of the faculties of arts of the several universities and others. A discussion of the nature and purpose of these examinations, of their value and limitations took place. As a result of this discussion it was unanimously agreed that the Matriculation Conference be asked to appoint a committee to carry out further investigations.

At a meeting of the Matriculation Conference held at the University of Toronto, December 21st, 1928, the following motion was submitted:

"That a committee be appointed consisting of five representatives of the universities, each university to name one, five representatives of the Department of Education, and five from the secondary school, to be named by the Department of Education, to investigate the whole matter of the new examinations and any possible value which they might have in connection with the matriculation and teachers' examinations and to report to the Matriculation Conference."

After discussion this motion was adopted.

The first report of this committee was received at a meeting of the Matriculation Conference held at the University of Toronto on December 20th, 1929. The chairman reported that the committee was making progress but that the final report of the committee would not be ready until the April meeting of the Conference.

At the meeting of the Conference held at the University of Toronto, on the 26th of April, 1930, the committee reported that considerable progress had been made, and that the Minister of Education had agreed to the preparation of Middle School papers of the new type in Algebra, Canadian History, Chemistry, French, Geometry, Latin and Physics. Twenty-five copies of each paper were to be sent to each secondary school in the Province with the request that they be written upon by candidates who expected to write the regular Middle School papers in the same subjects. In this way the committee would have at its disposal three marks for each pupil: the regular Middle School paper, the new-type paper, and the school marks. It was expected that a comparison of the three marks would provide the committee with further information on the value of the new examinations and their relation to school marks and to the older type of paper.

II

THE TESTS AND EXAMINATIONS

The new-type examinations having been authorized by the Minister of Education certain educators known to have been experimenting with this form of test were commissioned to prepare papers in the subjects decided on. New-type papers were prepared in Algebra, Canadian History, Chemistry, French, Geometry, Physics. There was also prepared a single three-hour paper in Latin for the purpose of comparing the value of a single three-hour paper in a foreign language with that of two 2½-hour papers. This paper was distinctly of the old-type resembling the new-type in one section of the paper only.

It must be noted here that these new-type papers, while employing the technique of standardized tests, were not themselves standardized but merely informal objective examinations. The items in the papers were not graded by experiment as in the case of standardized tests but the order of difficulty was based only on the judgment of the makers of the papers. One cannot expect then the same degree of reliability as is found in the better standardized tests. Two of the new-type papers, the French and the Latin, were examined by the teachers while the others were examined at the Department by clerks under the direction of capable supervisors. The French and Latin papers were also checked to see that the marking had been uniform. Allowance had to be made in examining for certain mistakes in the form of printers' errors. The new-type papers are given below followed by the corresponding Middle School papers. We shall hereafter refer to the new-type papers as tests and to the old-type papers as examinations.

MIDDLE SCHOOL ALGEBRA

Special Instructions

The candidate will read the following instructions before beginning to answer the paper:

(1) Answers only are to be written in the space provided.

(2) This paper with the answers on it is to be returned to the examiner.

(3) A separate sheet may be used for rough work if desired. This should seldom be necessary.

(4) Work carefully, do not check or test your answers until you have finished the paper.

(5) Answer the questions in the order in which they are given.

(6) Do not spend too much time over a question, rather pass on to the next one. Return later to solve omitted questions.

To the Examiner:

There are in all 50 questions, or part questions, on this paper. To get this total the three parts under question 1 are counted as one and all three answers must be correct or no credit for it shall be allowed.

A pupil's percentage shall be determined by finding the number of correct answers and multiplying this number by 2. No allowance shall be made for an answer that is not wholly correct.

		Answers
1. The sides of a rectangle are represented in length by a and b	The perimeter of the rectangle is....	.....
	The area of the rectangle is.....	.....
	The diagonal of the rectangle is.....	.....
2. A number has four digits, a, b, c, d, in order, d being the units digit	The algebraic expression of the number is.....	.....
3. If $a=2$, $b=-3$, $c=0$, write the values of....	(1) a^3-2b^2+3c.....	.....
	(2) $a^c-b^a+c^a$.....	.....
	(3) $a^{\frac{-2b}{a}}$.....	.....
	(4) $(a^2-b^2)+(b^2-c^2)+c^2-a^2)$.....	.....
4. Write the products of..	(1) $(2x-\frac{1}{3})$ and $(3x-\frac{1}{2})$.....	.....
	(2) $5x^2+4y^2$ and $5x^2+4y^2$.....	.....
	(3) $2a+b-c$ and $2a-b+c$.....	.....
	(4) y^2+2y+1 and $y+1$.....	.....
	(5) $2\sqrt{3}-3$ and $2\sqrt{3}+3$.....	.....
5. Write the quotients of.	(1) $15a^3b^2c-12a^2bc^3-3abc$ by $-3abc$	.....
	(2) $9x^2y^2-16z^2$ by $3xy-4z$.....	.....
	(3) $(x+y)^2+2(x+y)(a+b)+(a+b)^2$ by $x+y+a+b$.....	.....
	(4) $27x^3-27x^2+9x-1$ by $3x-1$....	.....
	(5) $a-b$ by $a^{\frac{1}{3}}-b^{\frac{1}{3}}$.....	.....
6. Write the factors of... (Nos. (1) and (3) have 3 factors each)	(1) $18x^4-11x^2+1$..... =	.....
	(2) $x^4+x^2y^2+y^4$..... =	.....
	(3) $4a^3-4a^2-a+1$..... =	.....
7. The L.C.M. of.....	x^2-1, x^3+1, x^2+x, x^2+2x+1 and x^2+4x+3..... =	.....
8 Simplify.....	(1) $\frac{a-b}{2}-\frac{b-c}{3}-\frac{c-a}{4}$..... =	.....
	(2) $\frac{x+y}{x-y}+\frac{4xy}{x^2-y^2}-\frac{y-x}{x+y}$..... =	.....
	(3) $\frac{2\sqrt{5}-\sqrt{7}}{2\sqrt{5}+\sqrt{7}}+\frac{2\sqrt{5}+\sqrt{7}}{2\sqrt{5}-\sqrt{7}}$..... =	.....
	(4) $4^{\frac{3}{4}}\times(6^{\frac{3}{4}})^{-2}\times\sqrt[3]{3}$..... =	.....
9. Write down the value or values of x in the equations opposite.....	(1) $17x-11=5x+121$..... $x=$	.....
	(2) $(x+5)(x+2)=x^2+6x+12$..... $x=$	.....
	(3) $x^2-5x+6=0$..... $x=$	.....
10. Write down the square root of.....	$x^4+4x^3+10x^2+12x+9$.....	.....

Answers

11. If $\frac{a}{b}=\frac{c}{d}$ which of the following statements are true? Write "true" or "false" after each

NOTE: a, b, c and d are all positive.

(1) $\frac{a}{c}=\frac{d}{b}$ .....

(2) $\frac{c}{a}=\frac{d}{b}$ .....

(3) $\frac{a+b}{a-b}=\frac{c+d}{c-d}$ .....

(4) $\frac{a}{b}=\frac{a^2+c^2}{b^2+d^2}$ .....

(5) If $a>c$ then $b>d$ .....

12. Find the fourth proportional to .....

16, 15, 8 .....

13. Write down the roots of

(1) $2x^2-3x+1=0$ ..... $x=$ .....
(2) $ax^2-bx-c=0$ .....
(3) $3x^2-21x+30=0$ .....
(4) $\sqrt{5x-1}-2\sqrt{x+3}=0$ .....
(5) $x^2-y^2=16$ and $x+y=8$ .....
(6) $x^2+4xy=33$ and $x+y=5$ .....

14. Study the following quadratic equations, and, without finding the roots, answer the questions opposite

(*a*) $x^2-5x-7=0$ .....
(*b*) $x^2+12x+36=0$ ...
(*c*) $3x^2-7x+3=0$ ....
(*d*) $x^2-2x+40=0$ ....
(*e*) $2x^2+3x-2=0$ ....

Which equation has
(1) equal roots? .....
(2) imaginary roots? .....
(3) real but irrational roots? .....
(4) rational and unequal roots? .....
(5) reciprocal roots? .....

What is
(1) the sum of the roots of (*c*)? .....
(2) the product of the roots of (*e*)? ...

15. Write: the equations required to solve these problems. (Do not solve them.)

(1) If 6 boys and 15 men earn \$234. a week and each man earns \$2. more than three times as much as each boy, how much does each boy earn? .....

(2) A fruit dealer buys apples at the rate of 5 for 3 cts., and sells them at the rate of 3 for 5 cts. How many apples must he buy and sell to gain \$1.28? .....

(3) A rectangular piece of cardboard whose length is 8 inches longer than its width has squares 4 inches to the side cut out of each

corner; the four flaps are folded up to form a lidless box which contains 960 cubic inches. Find the original width of the cardboard.

MIDDLE SCHOOL CANADIAN HISTORY

Time 2½ hours

1. Give the date of each of the following:
   (*a*) Cartier's first voyage to America .....
   (*b*) The Founding of Quebec by Champlain .....
   (*c*) Canada ceded to the English by the French .....
   (*d*) The Quebec Act passed .....
   (*e*) The Constitutional Act passed .....
   (*f*) The Battle of Queenston Heights .....
   (*g*) The union of Upper and Lower Canada .....
   (*h*) Confederation .....
   (*i*) The North-West Rebellion .....
   (*j*) The opening of the World War .....
2. Name each of the following persons:
   (*a*) The person who founded Montreal .....
   (*b*) The commander who captured Detroit in 1812 .....
   (*c*) The white man who first visited the Coppermine River .....
   (*d*) The first white man to reach the mouth of the Mackenzie River.
   (*e*) The commander of the Canadian Corps at the end of the World War .....

3. On the left is a list of geographical names, on the right a list of descriptive phrases. After each geographical name on the left place the number of the phrase which describes best the place named.

(*a*) Valcartier	1. On Cape Breton Island.
(*b*) Louisburg	2. On the Detroit River.
(*c*) Fort Frontenac	3. On the Saskatchewan River.
(*d*) Fort Duquesne	4. Near Quebec City.
(*e*) Batoche	5. Where Pittsburgh now stands.
	2. Where Kingston now stands.
	7. At the junction of the Ottawa and the St. Lawrence Rivers.
	8. Near Winnipeg.

4. Fill each blank in the following sentences with the name of a place or a district:
   (*a*) Wolfe made his last attempt to scale the Heights of Abraham at a spot known ever since as .....
   (*b*) The last place in Canada which the French surrendered to the English in the Seven Year's War was .....
   (*c*) LaSalle's greatest achievement was to reach the mouth of the ....
   (*d*) The first parliament of Upper Canada met at .....
   (*e*) After the Treaty of Ghent had been signed in 1814, a battle between the British and the Americans was fought at .....

5. The "causes" on the left led to the "results" on the right. Place after each result the number of its cause:

(1) Deadlock.	(*a*) Defeat of Sir John Macdonald
(2) Battle of the Plains of Abraham.	(*b*) Death of Riel.....
(3) North-West Rebellion.	(*c*) Lord Durham's Report.....
(4) Rebellion of 1837.	(*d*) Confederation.....
(5) The Pacific Scandal.	(*e*) The English captured Quebec

6. Name the following treaties:
   (*a*) The treaty which terminated Queen Anne's War (War of the Spanish Succession).....
   (*b*) The treaty which terminated the Seven Years' War.....
   (*c*) The treaty which terminated the American Revolution.....
   (*d*) The treaty which settled the Maine Boundary.....
   (*e*) The treaty which terminated the World War.....

7. Following the model given, supply the information indicated concerning the battles name below

Battle	Name of the War	Naval or land battle	The two sides
Battle of the Plains of Abraham	Seven Years' War	Land	British and French
(*a*) Moraviantown	.....	.....	.....
(*b*) Paardeberg	.....	.....	.....
(*c*) Jutland	.....	.....	.....
(*d*) Saratoga	.....	.....	.....

8. Below you will find the names of four acts which have determined, at different times, the form of government in Canada. This list is followed by fifteen statements, each of which is true about one of the four acts. Put after the name of each act the numbers of those statements which are true about it.
   (*a*) The Union Act.....
   (*b*) The Quebec Act.....
   (*c*) The British North America Act.....
   (*d*) The Constitutional Act.....

   (1) It provided for government by governor and council.
   (2) It established French civil law and English criminal law in Canada.
   (3) It extended the boundaries of Canada to the Ohio and Mississippi Rivers.
   (4) It divided Canada into Upper Canada and Lower Canada.
   (5) It established legislative councils and legislative assemblies in Canada.
   (6) It united Upper and Lower Canada.
   (7) It divided Canada into Ontario and Quebec.
   (8) It established a federation of four provinces.
   (9) It gave equal representation in the Assembly to Upper and Lower Canada.

(10). It made provision for the establishment of clergy reserves in Upper Canada.
(11) It was partly caused by political deadlock.
(12) It was partly the result of an agitation for representation by population.
(13) It established the Dominion of Canada.
(14) It was partly caused by Lord Durham's Report.
(15) It established representative government in Canada.

9. Below is a list of governors, and a series of statements each of which is true about one of the governors. Place after each name of a governor the numbers of the statements which are true about him:

(*a*) Lord Sydenham.....
(*b*) Lord Durham.....
(*c*) Sir Guy Carleton (Lord Dorchester).....
(*d*) Lord Elgin.....
(*e*) Sir Charles Metcalf.....

(1) He helped to bring many United Empire Loyalists to Canada.
(2) He was largely responsible for the passing of the Constitutional Act.
(3) He signed the Rebellion Losses Bill.
(4) He was sent to Canada to investigate conditions after the Rebellion of 1837.
(5) He organized the first cabinet in Canada.
(6) He negotiated a reciprocity treaty between Canada and the United States.
(7) He caused the resignation of the first Baldwin-Lafontaine Ministry.
(8) He recommended the establishment of responsible government in Canada.
(9) He organized a system of municipal government in Canada.
(10) He recommended the establishment of municipal government in Canada.

10. Below you will find the names of eleven public men, and fifteen statements each of which is true about one of the men. Place after the name of each man the numbers of the statements which are true about him:

(*a*) Sir Francis Hincks.....
(*b*) George Brown.....
(*c*) William Lyon Mackenzie.....
(*d*) Robert Baldwin.....
(*e*) Alexander Mackenzie.....
(*f*) Joseph Howe.....
(*g*) Sir Wilfred Laurier.....
(*h*) Sir Robert Borden.....
(*i*) Sir Charles Tupper.....
(*j*) Sir John A Macdonald.....
(*k*) John Sandfield Macdonald.....

(1) He was a leader in the Rebellion of 1837.
(2) He was a leader of the Moderate Reformers in 1837.

(3) He was the first premier of the Dominion of Canada.
(4) He was the chief political opponent of Joseph Howe.
(5) He was the first mayor of Toronto.
(6) He introduced the Municipal Act of 1849.
(7) He was the first premier of Ontario.
(8) He was a leader of the Clear Grits.
(9) He opposed the federation of Nova Scotia with Canada.
(10) He was premier of Canada during the World War.
(11) He became leader of the Upper Canadian Liberals in 1851.
(12) He led the agitation for representation by population.
(13) He was the chief advocate of "The National Policy."
(14) He was the second premier of the Dominion of Canada.
(15) He was a Liberal, and was premier of the Dominion of Canada for 15 years.

11. Complete the following sentences by filling the blanks with appropriate words:

(*a*) To become a Dominion law, a bill must be passed by the..... .....and the....., and be signed by the.....
(*b*) To become a provincial law in Ontario, a bill must be passed by the.....and be signed by the.....

12. The following is a list of powers exercised by the provinces and the Dominion. Place after A the numbers of the powers which belong to the provinces, and after B the powers which belong to the Dominion.

A.....

B.....

(1) The establishment and maintenance of prisons, reformatories, hospitals and asylums.
(2) The raising of revenue by the imposition of duties on imports.
(3) The administration of the post-office service.
(4) The defence of the country.
(5) The regulation of the solemnization of marriage.
(6) The control of trade and commerce.
(7) The control of municipal institutions.
(8) The control of education.

13. Below is a list of writings by Canadian authors. Place opposite each the name of its author:

1. The Golden Dog.....
2. The Seats of the Mighty.....
3. Jean Rivard.....
4. The Habitant.....
5. Sam Slick.....
6. The Story of a People.....
7. Wild Animals I Have Known.....
8. Songs of a Sourdough.....
9. In Flanders Fields.....
10. Wacousta.....

14. Mark each of the following statements as true or false by placing in the bracket at the right a plus sign (+), if you think the statement is true, or a zero sign (0), if you think the statement is false in whole or in part. Do not guess. The chances are against you if you do so.

(1) Seigniorial tenure of land was introduced into Canada by the French ( )
2. Seigniorial tenure was abolished immediately after the conquest of Canada by the English ( )
3. The seignior vowed fealty and homage to the king ( )
(4) The habitants held their lands directly from the king ( )
(5) The coureurs de bois were French Canadians who preferred to farm rather than to hunt and trade ( )
(6) Jean Talon endeavoured in every way to encourage industry and trade in Canada ( )
(7) The United Empire Loyalists came to Canada because they wished to live under the British flag ( )
(8) The United Empire Loyalists suffered great hardships in Canada because the British Government refused to give any assistance ( )
(9) The early settlement of Upper Canada was to a large extent military ( )
(10) The emigrant ships which brought settlers from Great Britain in the time of Lord Durham were clean and sanitary ( )
(11) The lot of the early settlers in Upper Canada was made easy by the presence of good timber on the land ( )
(12) The early settlers had plenty of implements with which to clear the land and cultivate it ( )
(13) The early settlers brought most of their furniture with them from Europe or the United States ( )
(14) Yonge Street from Toronto to Lake Simcoe was built by Governor Simcoe ( )
(15) By 1837 there were many good roads in Upper Canada ( )
(16) When Lord Sydenham came to Canada in 1839, he found it easy to travel up the St. Lawrence from Montreal to Kingston ( )
(17) The first school in Upper Canada was opened at Kingston by Dr. John Stuart ( )
(18) The most celebrated of the early schoolmasters of Upper Canada was Rev. John Strachan ( )
(19) The old soldiers who taught many of the early country schools were well educated men ( )
(20) The University of Toronto began its work in 1843 under the name of King's College ( )
(21) Victoria University in Cobourg and Queen's University in Kingston were founded by the Methodists and the Presbyterians ( )
(22) Because of the favour of the British Government and the Lieutenant-Governor, the Church of England grew more rapidly, in the early years of the nineteenth century, than any other church in Upper Canada ( )

(23) In 1849 the University of Toronto was freed from religious control, with the approval of Bishop Strachan..... ( )
(24) The first Canadian railway ran from La Prairie to St. Johns ( )
(25) The first important railway in Canada was the Grand Trunk from Portland to Sarnia..... ( )
(26) From the first the Grand Trunk Railway was a financial success..... ( )
(27) The first vessel to cross the Atlantic under steam was the Royal William, which was built at Quebec..... ( )
(28) The city of Halifax was founded in 1749 by a group of disbanded soldiers under Edward Cornwallis..... ( )
(29) Agriculture was the first industry to develop largely in Nova Scotia..... ( )
(30) The chief opposition to the establishment of the Selkirk Settlement on the Red River came from the Indians.... ( )
(31) The Huron Missions on Georgian Bay were destroyed by the English..... ( )
(32) The chief mission stations among the Hurons on Georgian Bay were St. Ignace, St. Louis, and Ste. Marie..... ( )
(33) Pierre Gaultier de la Vérendrye was the first white man to establish a fort where Winnipeg now stands..... ( )
(34) Hearne was the first explorer to reach the Pacific Ocean overland from Canada..... ( )
(35) John A. Macdonald was the son of a wealthy Highlander who settled near Kingston..... ( )
(36) John A. Macdonald succeeded in uniting the Conservatives and the Moderate Liberals in the Liberal Conservative Party..... ( )
(37) Wilfrid Laurier succeeded Edward Blake as leader of the Liberal Party..... ( )
(38) Preferential trade between Canada and Great Britain was brought about by the Government of Sir John A. Macdonald..... ( )
(39) The Government of Sir Wilfrid Laurier succeeded in 1911 in establishing reciprocity in trade with the United States ( )
(40) Hon. Arthur Meighen succeeded Sir Robert Borden as premier of the Dominion of Canada..... ( )

MIDDLE SCHOOL CHEMISTRY

Time 2½ hours

Part A

Directions:

Place a plus sign (+) within the brackets at the right of each *true* statement, and a zero (0) at the right of each *false* statement.

Avoid marking statements concerning which you know nothing at all. Avoid pure guesses.

Use a soft lead pencil.

Examples:

Oxygen is a liquid at 20° C. and 760 mm. pressure.....(0)
Plastic sulphur is an allotropic form of sulphur.....(+)

1. The turning of water into steam is a chemical change.....( )
2. All acids contain hydrogen.....( )
3. When pure carbon burns in oxygen, there is a flame.....( )
4. Sodium is kept under water.....( )
5. Mercuric oxide, when strongly heated, turns black.....( )
6. About eight-ninths of the air by weight is oxygen.....( )
7. When sodium oxide is added to water, blue litmus placed in the latter is turned red.....( )
8. When phosphorus burns in air a solid is formed.....( )
9. Sulphur dioxide is a slightly reddish gas.....( )
10. Water boiled with magnesium oxide turns red litmus blue.....( )
11. When calcium is placed in cold water hydrogen is formed.....( )
12. Burning magnesium is extinguished when placed in steam.....( )
13. Steam converts red-hot iron to magnetic iron oxide.....( )
14. To secure oxygen from potassium chlorate, manganese dioxide must be added.....( )
15. The white ash formed when magnesium burns in air has a total weight less than that of the magnesium which burns.....( )
16. Hydrogen is given off when copper is placed in dilute nitric acid.....( )
17. Hydrogen escapes from an inverted test-tube more quickly than from one held mouth upwards in air.....( )
18. Powdered sugar is more soluble in water than lump sugar.....( )
19. In brine the solute is common salt.....( )
20. Bromine is more soluble in carbon disulphide than in water.....( )
21. Sodium hydroxide is deliquescent.....( )
22. Anhydrous copper sulphate is blue.....( )
23. In $CaCl_2$ the valency of Ca is two.....( )
24. In $Ca_2(PO_3)_4$ the valency of PO_4 is two.....( )
25. When sodium chloride is heated with sulphuric acid, chlorine is given off..( )
26. A solution of silver nitrate gives a white precipitate with hydrochloric acid( )
27. Lime water is a chemical compound.....( )
28. Dry chlorine bleaches dry litmus paper.....( )
29. Bromine displaces chlorine from chlorides.....( )
30. Chlorine is as soluble in water as hydrogen chloride is.....( )
31. Chlorine may be obtained from hydrochloric acid.....( )
32. When sodium bicarbonate is strongly heated carbon dioxide is given off...( )
33. Marble and hydrochloric acid in contact form calcium chloride.....( )
34. Wood contains carbon.....( )
35. Carbon dioxide burns in oxygen.....( )
36. Water which contains calcium bicarbonate in solution is said to be permanently hard.....( )
37. The bright flame of acetylene is due in part to its high temperature....( )
38. When acetylene burns from a large opening no carbon is given off.....( )
39. Acetylene is more soluble in water than in acetone.....( )
40. Gunpowder is a chemical compound.....( )
41. Baking powder is a mechanical mixture.....( )
42. Methane sometimes occurs in coal mines.....( )
43. Water gas is a mixture of gases.....( )
44. When sulphur first melts, it is very viscous.....( )
45. Sulphur often occurs in what appear to be diamond-shaped crystals....( )
46. Rhombic sulphur readily turns into the monoclinic form at room temperature.....( )

47. Hydrogen sulphide has a very disagreeable odour.....( )
48. Hydrogen sulphide is heavier than sulphur dioxide.....( )
49. Hydrogen sulphide turns moistened blue litmus paper red.....( )
50. Many metallic sulphides are insoluble in water.....( )
51. Potassium nitrate has the same composition as Chile saltpetre.....( )
52. Copper and concentrated nitric acid give off a brown gas.....( )
53. Ammonia is a chemical element.....( )
54. There are more chemical elements than chemical compounds.....( )
55. The litre is a unit of weight.....( )
56. Bromides contain no oxygen.....( )
57. A catalytic agent alters the speed of a chemical change.....( )
58. Graphite is an amorphous form of carbon.....( )
59. Carbon monoxide is a poisonous gas.....( )
60. Carbon dioxide is a good fuel.....( )
61. Iodine vapour is brown.....( )
62. Iodine vapour sublimes when it cools.....( )
63. Bromine displaces iodine from iodides.....( )
64. Ammonia gas extinguishes glowing charcoal.....( )
65. A lighted wax taper burns brilliantly in carbon dioxide.....( )
66. Silver bromide is used in photography.....( )
67. Sulphur dioxide is used for bleaching.....( )
68. Chlorine usually bleaches by oxidizing the coloured substances.....( )
69. Bromine is a liquid at 10^0C.....( )
70. Nitrogen peroxide is colourless at room temperature.....( )
71. Nitric acid is a good oxidizing agent.....( )
72. Oxygen is made commercially from liquid air.....( )
73. Green plants give off carbon dioxide in sunlight.....( )
74. An increase of pressure renders a gas more soluble in water.....( )
75. Nitrous oxide may be collected by the upward displacement of air.....( )
76. Bleaching powder is made by the action of chlorine on calcium carbonate.( )
77. Chlorine is liberated from bleaching powder by the action of acids.....( )
78. All acids contain oxygen.....( )
79. The names of binary compounds usually end in "ide".....( )
80. Sulphur melts at 96^0C.....( )
81. When sulphur sublimes the substance called flowers of sulphur is formed.( )
82. Solid sulphur has three well-known allotropic forms.....( )
83. Rhombic sulphur dissolves in carbon disulphide.....( )
84. A solution of acetylene in water turns red litmus blue.....( )
85. A solution of ammonia in water neutralizes acids.....( )
86. A solution of potassium iodide in water turns boiled starch paste blue.....( )
87. Iodine does not dissolve in carbon disulphide.....( )
88. Carbon is a reducing agent.....( )
89. Carbon dioxide is an acid anhydride.....( )
90. The boiling point of water is lowered by the addition of salt.....( )
91. Oxygen may be readily obtained from sodium peroxide.....( )
92. Sulphur dioxide combines readily with oxygen.....( )
93. Carbon monoxide burns with a blue flame.....( )
94. Hydrogen sulphide does not burn in air.....( )
95. Wood charcoal *absorbs* some gases.....( )
96. Ammonia is readily prepared by heating ammonium nitrate.....( )
97. Carbon monoxide has a higher percentage of carbon by weight than carbon dioxide has.....( )

98. Sulphur dioxide is more soluble in water than is nitric oxide.....( )
99. Sodium does not combine directly with chlorine.....( )
100. The valency of an element is the number of atomic weights of that element that combines with or displaces one atomic weight of hydrogen.( )

Part B

Directions:

Fill in each blank with the word or words which make the statement true.

Example:

All oxides contain the element Oxygen.

Note: The following atomic weights may be used when needed: O = 16, H = 1, C = 12, S = 32. It is unnecessary to work out any of the fractions.

1. The Law of Conservation of Mass states that.....of the reacting substances is.....after a reaction as before.
2. In all samples of a chemical compound the.....are present in ..... proportions by weight. This is the Law of.....
3. In one sample of carbon dioxide, 3 gms. of carbon were found in combination with 8.0001 gms. of oxygen, and in another sample of the same substance 9 gms. of carbon with 24.0003 gms. of oxygen. These facts illustrate the Law of.....
4. Several samples of carbon monoxide when analysed show the composition of this compound to be 6 gms. of carbon to 8 gms. of oxygen. The statements in (3) and (4) taken together illustrate the Law of.....
5. The Law of Combining Volumes states that in any chemical reaction the .....of the reacting gases, if measured at the same temperature and pressure are in the ratio.....numbers.
6. The volume of a gas varies.....as the temperature, measured on the.....scale, if the.....and.....are kept constant. This is called.....Law.
7. The volume of a gas varies.....as.....if the temperature and.....are kept constant. This is called.....Law.
8. As the temperature of a liquid increases, the solubility of a solid in it usually.....
9. As the temperature of a liquid increases, the solubility of a gas in it usually.....
10. In a mechanical mixture the components.....their original chemical properties.
11. A solution differs from a mechanical mixture by being.....
12. Copper boiled with concentrated sulphuric acid forms a gas called.....
13. A physical property.....involve a change of substance.
14. When a mixture of 8 cc. of hydrogen and 8 cc. of oxygen is exploded there remains unchanged....cc. of.....gas, all being measured at the same temperature and pressure.
15. Red oxide of lead is thoroughly mixed with powdered charcoal and strongly heated in a crucible for some time. A new substance.....is formed in the crucible and.....passes off. The charcoal in this case is.....agent.
16. If 100 cc. oxygen at N.T.P. are brought to—10°C. and 800 mm. pressure, the new volume is represented by this fraction.....
17. Compounds composed of a metal and an acid radicle are called.....

18. Sulphates contain the radicle.....
Nitrates contain the radicle.....
Sulphites contain the radicle.....
Bases contain the radicle.....
19. The formula for bleaching powder is....., for baking soda ....., for saltpetre....., for quick lime....., for caustic potash.....
20. Reactions in which heat is absorbed are called.....
21. In H_2S the valency of S is..... In CuS the valency of Cu is.....
22. When water, acidulated with sulphuric acid is electrolysed, hydrogen is liberated at the.....and.....at the .....
23. If a solid being added to a solution causes the precipitation of more solid, the solution is said to be.....
24. The percentage of hydrogen in water by weight is represented by this fraction.....
25. The density of chlorine gas is.....than that of air.
26. Ammonia gas turns moistened.....litmus paper.....
27. When a mixture of potassium chlorate and manganese dioxide is heated, the substance named.....acts as a catalyst.
28. Lime water exposed to the air becomes coated with a substance called .....
29. One litre of carbon dioxide weighs.....times as much as one litre of oxygen at the same temperature and pressure.
30. Chlorine is.....soluble in water than hydrogen is.
31. A moistened silver coin turns.....in colour when placed in hydrogen sulphide.
32. A burning piece of wood.....if placed in nitrous oxide.
33. If a solid becomes moist when exposed to air it is said to be.....
34. A salt containing water of crystallization is called a.....
35. A reducing agent usually removes.....from the substance reduced.
36. If 3 gms. of hydrogen combine with 14 gms. of nitrogen to form a chemical compound, the combining weight of nitrogen is.....
37. One litre of oxygen at 20°C. and 760 mm. pressure weighs.....times as much as one litre of oxygen at 10°C. and 760 mm.
38. The atomic weight of diamond is.....the atomic weight of graphite.
39. Acetylene may be made by adding.....to.....
40. When water gas burns in air the resulting substances are.....
.....
41. When sodium nitrate is heated with sulphuric acid.....and .....are formed.
42. 10 cc. of nitric oxide combine with.....cc. of.....measured at the same temperature and pressure to form nitrogen peroxide. This illustrates the Law of.....
43. The percentage of carbon in acetylene is represented by the fraction.....
44. Hydrogen sulphide is.....soluble in hot water than in cold water.
45. In 100 cubic feet of water gas there are.....cubic feet of.....and..... cubic feet of.....measured under the same conditions.
46. Washing soda crystals when exposed to the air become.....
.....and are consequently said to be efflorescent.

47. .....and.....are the two most soluble gases.
48. Oxides of.....when added to water usually form bases.
49. An oxide which combines with water to form an acid is called.....
.....
50. An acid added to the solution of a base forms.....and..... This is called.....

PART C

The above represents apparatus used to determine the percentage composition of water by weight. Dry hydrogen is passed over dry heated copper oxide and the resulting water is collected and weighed in the tube G. Below are a number of statements about this experiment. To complete each of these statements one of the group of words lettered (*a*), (*b*), (*c*) or (*d*) must be selected. Indicate the one you select by placing the proper letter within the brackets.

Example: The beaker J contains concentrated sulphuric acid.....(b)
(*a*) to collect carbon dioxide.
(*b*) to prevent water vapour from the air passing back into tube G.
(*c*) to allow resulting gas to escape.
(*d*) to cause the correct pressure in A.

1. The flask A contains.....( )

(*a*) copper and sulphuric acid.
(*b*) zinc, water and sulphuric acid.
(*c*) magnesium and water.
(*d*) zinc and sulphuric acid only.

2. The liquid in the thistle tube stands at the level x because.....( )

(*a*) too much material has been placed in the flask.
(*b*) the contents of A become hot.
(*c*) of the influence of the liquid in bottle C.
(*d*) of the temperature of F.

3. The hydrogen becomes dry in C because this bottle contains.....( )

(*a*) a solution of calcium chloride in water.
(*b*) dilute sulphuric acid.
(*c*) concentrated sulphuric acid.
(*d*) ether.

4. The hydrogen must be dried because.....( )

(*a*) moist hydrogen does not react with copper oxide.
(*b*) the combustion tube F might break.
(*c*) copper hydroxide might be formed in F.
(*d*) the weight of the water produced in F could not be accurately determined if the hydrogen were not dry.

5. The colour of the new substance remaining in F is.....( )

(*a*) blue.
(*b*) reddish-brown.
(*c*) canary-yellow.
(*d*) white.

6. The tube G contains.....( )

(*a*) lumps of calcium chloride.
(*b*) finely powdered calcium chloride.
(*c*) concentrated sulphuric acid.
(*d*) a strong solution of caustic soda.

7. The gas bubbling through the concentrated sulphuric acid in J is.....( )

(*a*) oxygen.
(*b*) nitrogen.
(*c*) ammonia.
(*d*) hydrogen.

School.....

Candidate.....

MIDDLE SCHOOL FRENCH

Time 2½ hours

Students are advised to divide their time on this paper as follows: 60 minutes for part A; 40 minutes for part B; in part C 10 minutes should be allowed for each composition. This plan will leave 30 minutes for a review of the whole paper. Do not spend too much time on any one part. Be sure and write on the whole paper.

A

Read the following paragraphs and show that you have understood them by answering in English the question attached to each. Write the answers on the dotted lines underneath the questions. *No credit will be given for answers written in French.* Answers should be brief; for the most part not more than four or five words. Do not spend too much time on any one question.

I

Quand j'arrivai à Nîmes, je rencontrai beaucoup d'écoliers qui venaient comme moi passer leur baccalauréat. Ils étaient, pour la plupart, accompagnés de leurs parents, beaux messieurs et belles dames, avec les poches pleines de recommendations. Moi, petit campagnard, je me sentais infiniment petit car je ne connaissais absolument personne: et tout mon recours, pauvret, était de dire à part quelque prière à Saint Baudile, qui est le patron de Nîmes, pour qu'il mît dans le cœur des examinateurs un peu de bonté pour moi.

1. Qui a-t-il recontré en arrivant à Nîmes?
.....
2. Pourquoi sont-ils venus à Nîmes?
.....
3. Qui a accompagné les écoliers?
.....
4. Qu'est-ce qu'il y avait dans les poches de ceux qui accompagnaient les écoliers?
.....
5. Qu'est-ce que c'est qu'un campagnard?
.....
6. Pourquoi le petit campagnard se sentait-il petit?
.....
7. Qu'est-ce que le petit campagnard a prié Saint Baudile de faire?
.....
8. Qui est Saint Baudile?
.....

II

Il n'avait pas fermé l'œil de la nuit, le brave François, à la pensée qu'il faudrait reporter au commissaire cet enfant qui avait si froid et si faim.

Il s'attendait à une nouvelle scène au réveil; mais la mère Louveau avait d'autres idées en tête, car elle ne lui parla pas de Victor.

François croyait gagner beaucoup en reculant l'heure de l'explication. Il ne songeait qu'à échapper à l'œil de sa femme, travaillant de tout son cœur, de peur que la mère Louveau, le voyant oisif, ne lui criât:—Dis donc, toi, puisque tu ne fais rien, reconduis le petit où tu l'as pris.

9. Qu'est-ce qui a empêché François de dormir?

.....

10. Comment s'appelait l'enfant?

.....

11. Pourquoi la mère Louveau n'a-t-elle pas parlé de Victor à François?

.....

12. A quoi songeait François?

.....

13. Que faisait-il? ?

.....

14. Qu'est-ce que François a peur que sa femme ne lui crie?

.....

III

Le charpentier était un homme maigre. Il vivait seul, en dehors du village, en pleine forêt.

On ne lui connaissait pas d'amis.

La curiosité villageoise avait été longtemps intriguée par la solitude et le silence de cet inconnu qui était venu, du fond de la Nièvre, monter un chantier à l'écart des autres.

Depuis six ans, il travaillait par tous les temps, sans jamais chômer, comme un homme à la peine, bien qu'il passât pour avoir beaucoup de "denrée," fit de gros marchés, et allât souvent consulter le notaire de Corbigny sur le placement de ses économies.

Un jour il avait dit à M. le curé qu'il était veuf.

On n'en savait pas plus.

15. Où demeurait le charpentier?

.....

16. Qui vivait avec lui?

.....

17. Quel effet la solitude et le silence du charpentier avaient-ils sur les villageois?

.....

18. Qu'est-ce qu'il a fait en arrivant du fond de la Nièvre?

.....

19. Qui consultait-il sur le placement de ses économies?

.....

20. Qu'est-ce qu'on savait de lui?

.....

IV

Jean, *seul, achevant d'essuyer un fauteuil.*—Midi moins un quart.....C'est aujourd'hui que Monsieur Perrichon revient de voyage avec madame et mademoiselle.....J'ai reçu hier une lettre de monsieur.....la voilà. (*Lisant*) "Grenoble, 5 juillet. Nous arriverons mercredi, 7 juillet, à midi. Jean nettoiera l'appartement et fera poser les rideaux." (Parlé) C'est fait. (*Lisant*) "Il dira à Marguerite, la cuisinière, de nous préparer le dîner. Elle mettra le pot-au-feu.....un morceau pas trop gras.....de plus, comme il y a longtemps que nous n'avons mangé de poisson de mer, elle nous achètera une petite barbue bien fraîche.....Si la barbue était trop chère, elle la remplacerait par un morceau de veau à la casserole." (Parlé) Monsieur peut arriver.....tout est prêt.....Voilà ses journaux, ses lettres, ses cartes de visite.

21. Qu'est-ce que Jean avait achevé de faire?

.....

22. Quelle heure était-il?

.....

23. Comment Jean savait-il que les Perrichon allaient revenir?

.....

24. Qu'est-ce que Jean devait faire dans l'appartement?

.....

25. Qui était Marguerite?

.....

26. Quelle espèce de poisson allait-on manger?

.....

V

Perichon, *à part.*—Je suis très contrarié.....très contrarié j'ai passé une partie de la nuit à écrire à mes amis que je me battais.....je vais être ridicule.

Armand, *à part.*—Il doit être bien disposé.....Essayons. (*Haut.*) Mon cher monsieur Perrichon.....?

Perichon, *sèchement.*—Monsieur?

Armand.—Je suis plus heureux que je ne puis le dire d'avoir pu terminer cette désagréable affaire.

Perichon, *à part.*—Toujours son petit air protecteur! (*Haut.*) Quant à moi, monsieur, je regrette que vous m'ayez privé du plaisir de donner une leçon à ce professeur de grammaire.

27. Qu'est-ce que Perrichon a fait pendant la nuit?

.....

28. Quelle nouvelle a-t-il donné à ses amis?

.....

29. Pourquoi Perrichon était-il contrarié?

.....

30. Pourquoi Armand était-il heureux?

.....

31. De quoi Armand a-t-il privé Perrichon?

.....

VI

Le palais de la princesse Mimi était entouré d'un grand parc que traversait un fleuve bleu. Au milieu du fleuve, sur une petite île pareille à un bouquet,

s'élevait un pavillon de fines porcelaines coloriées, avec des fenêtres faites de pierres précieuses. L'architecte avait donné à ce pavillon la forme et l'aspect d'une immense tulipe. La princesse avait coutume d'y passer de longues heures, pour la joie de se sentir suspendue entre l'azur du fleuve et l'azur du ciel.

Un jour qu'elle etait là, à demi couchée, rêvant à demi les yeux mi-clos et chantant de petites chansons mélancoliques, elle ne s'aperçut pas que le fleuve montait autour d'elle. Enfin le grondement des vagues la tira de son demi-sommeil, et, ouvrant la fenêtre, elle vit que le pont qui conduisait à l'île était submergé et que bientôt l'eau entrerait dans le pavillon.

32. De quelle couleur était la rivière qui traversait le parc?
.....
33. Où se trouvait le pavillon de la princesse?
.....
34. A quoi ressemblait ce pavillon?
.....
35. Pourquoi la princesse passait-elle des heures dans le pavillon?
.....
36. Que faisait la princesse pendant que le fleuve montait autour d'elle?
.....
37. Qu'est-ce qui a éveillé la princesse?
.....

VII

Il y a une demi-semaine que l'oncle Flo est mon hôte, et les journées, les soirées surtout, me semblent singulièrement lourdes. A la maison, il ne bouge pas de mon cabinet de travail, se sert de mes ustensiles de toilette et m'ennuie en racontant ses succès à la Société horticole de Villotte. Ce n'est rien auprès des promenades à travers la ville! Bien qu'il ne soit venu à Paris que cinq ou six fois en vingt ans, l'oncle Florent se vante de tout connaître. Il veut être pris pour un Parisien pur sang et, lorsqu'il sort seul, il se couperait la langue plutôt que de demander son chemin.

38. Depuis quand l'oncle Flo est-il mon hôte?
.....
39. Quelle chambre de la maison préfère-t-il?
.....
40. Comment est-ce qu'il m'ennuie?
.....
41. Combien de fois est-il venu à Paris en vingt ans?
.....
42. De quoi se vante-t-il?
.....
43. Quelle est sa plus grande ambition?
.....
44. Que ferait-il plutôt que de demander son chemin?
.....

VIII

L'extérieur de Jean-Paul révélait son caractère désordonné. Mais ce qui, bien plus que le reste, faisait de lui un enfant tout à fait désagréable, c'était sa conduite malicieuse envers et contre tous. Jean-Paul semblait n'avoir d'autre

plaisir que le déplaisir des autres. Aux tours inventés avant lui, il en ajoutait de sa façon, lesquels prouvaient un génie méchamment inventif. C'est ainsi qu'au collège il battait les plus petits pour leur prendre une partie de leur goûter si le sien ne lui suffisait pas.

45. Qu'est-ce qui révélait le caractère de Jean-Paul?
.....
46. Qu'est-ce qui rendait Jean-Paul tout à fait désagréable?
.....
47. Quel semblait être le plus grand plaisir de Jean-Paul?
.....
48. Qu'est-ce qu'il ajoutait aux tours inventés avant lui?
.....
49. Qu'est-ce qui prouvait qu'il avait un génie inventif?
.....
50. Quels écoliers avait-il l'habitude de battre?
.....

B

Each of the English sentences below is followed by a translation which is correct but incomplete. Each translation can be completed by inserting one or more words in the blank (. .). When you have decided upon the words that are necessary to complete the translation, *write these on the dotted line at the right of the page.* Be sure the words that you have added complete the sentence. *Do not write out the whole sentence.* Write only the words necessary to complete the translation.

Answers

1. Where is the ink? Où est (. .) encre? 1.....
2. A beautiful house. Une (. .) maison. 2.....
3. He has his pen. Il a (. .) plume. 3.....
4. The snow is white. La neige est (. .) 4.....
5. Three boats (bateau). Trois (. .). 5.....
6. The boy's pencil. Le crayon (. .) garçon. 6.....
7. These jewels (bijou) are costly. Ces (. .) sont coûteux. 7.....
8. The knife that I have is small. Le couteau (. .) j'ai est petit. 8.....
9. The ruler is long. La règle est (. .). 9.....
10. I haven't any bread. Je n'ai pas (. .) pain. 10.....
11. Speak to the children. Parlez (. .) enfants. 11.....
12. The horses are here. Les (. .) sont ici. 12.....
13. Bread is good. (. .) est bon. 13.....
14. I give them to him. Je (. .) donne. 14.....
15. We have some good books. Nous avons (. .) bons livres. 15.....
16. He has come. Il (. .) venu. 16.....
17. He will give you some. Il (. .) donnera. 17.....
18. How old is he? (. .) a-t-il? 18.....
19. The best pupil in the class. Le meilleur élève (. .) la classe. 19.....
20. I need some money. Il me faut (. .) argent. 20.....
21. He has some meat. Il a (. .) viande. 21.....

Answers

22. Most of the children say so. La plupart (. .) enfants le disent. 22.....
23. We went out (sortir) at eight o'clock. Nous sommes (. .) à huit heures. 23.....
24. We got up late. Nous nous (. .) levés tard. 24.....
25. She is hungry. Elle (. .). 25.....
26. He will see you when he comes. Il vous verra quand il (. .). 26.....
27. It is cold to-day. Il (. .) aujourd'hui. 27.....
28. He lives in Canada. Il demeure (. .) Canada. 28.....
29. What time is it? (. .) est-il 29.....
30. A little butter, please. (. .) beurre, s'il vous plaît. 30.....
31. He was behind her. Il se trouvait derrière (. .). 31.....
32. He opened the door. Il a (. .) la porte. 32.....
33. They cannot go. Ils ne (. .) pas aller. 33.....
34. They wish to go. Ils (. .) partir. 34.....
35. Which pencils do you wish? (. .) crayons voulez-vous? 35.....
36. They went to bed early. Il se sont (. .) de bonne heure. 36.....
37. I knew (connaître) him in France. Je l'ai (. .) en France. 37.....
38. If he had the money he would buy it. S'il (. .) l'argent il l'achèterait. 38.....
39. The second of January. Le (. .) janvier. 39.....
40. Your pens and mine. Vos plumes et (. .). 40.....
41. A low (bas) door. Une porte (. .). 41.....
42. You are drinking. Vous (. .). 42.....
43. I saw him an hour ago. Je l'ai vu (. .) une heure. 43.....
44. He is at your aunt's. Il est (. .) votre tante. 44.....
45. Stop talking. Cessez (. .). 45.....
46. It is easy to talk. Il est facile (. .) parler. 46.....
47. He said nothing to anybody. Il n'a rien dit à (. .). 47.....
48. I like apples. J'aime (. .) pommes. 48.....
49. He was sitting before the fire. Il était (. .) devant le feu. 49.....
50. She washed (laver) her face. Elle s'est (. .) la figure. 50.....
51. He and I will go. (. .) nous irons. 51.....
52. It is a quarter past seven. Il est (. .). 52.....
53. Give it to them. (. .). 53.....
54. A pen? Take the one that is on the table. Une plume? Prenez (. .) qui est sur la table. 54.....
55. He gave them to us. Il (. .) a donnés. 55.....
56. He is a doctor (docteur). Il est (. .). 56.....
57. They were born (naître) the same year. Ils (. .) la même année. 57.....
58. I saw him on the first of April. Je l'ai (. .) avril. 58.....
59. It is half-past six. Il est (. .). 59.....
60. I will tell you before leaving (partir). Je vous le dirai avant (. .). 60.....

61 That costs two francs a foot. Cela coûte deux francs (. .) pied. 61.....
62. I left them on the table. Je les ai (. .) sur la table. 62.....
63. They put (mettre: past definite) it on the table. Ils le (. .) sur la table. 63.....
64. Which one of the books do you want? (. .) des livres voulez-vous? 64.....
65. It is better that you should speak to him. Il vaut mieux que vous lui (. .). 65.....
66. You must see him. Il faut que vous le (. .). 66.....
67. What is on the chair? (. .) est sur la chaise? 67.....
68. My pencils are longer than those. Mes crayons sont plus longs que (. .). 68.....
69. He took (conduire: past definite) me to the station. Il me (. .) à la gare. 69.....
70. He wishes you to come to-morrow. Il veut (. .) demain. 70.....
71. I know what will happen. Je sais (. .) arrivera. 71.....
72. The book is ten inches long. Le livre est (. .) dix pouces. 72.....
73. The man with the blue eyes. L'homme (. .) yeux bleus. 73.....
74. He is the oddest man that I know (connaître). C'est l'homme le plus bizarre que je (. .). 74.....
75. He has no friends who can help him. Il n'a pas d'amis qui (. .) l'aider. 75.....

C

Write in French about 50 words on *each of two* of the following subjects:

1. A day in school.
2. A trip to the dressmaker's.
3. Plans for the summer.
4. Our new house.

MIDDLE SCHOOL GEOMETRY

Time 2½ hours

NOTE: Please read carefully the instructions given before attempting the paper.
(1) Do the questions in order.
(2) Do not spend too long at any one question. Pass on to the next question and return to the unsolved questions after completing the paper.
(3) At the close of the examination, hand this paper to the presiding officer.

A. *Constructions required to solve problems:*

NOTE: (1) Make the constructions indicated on the diagrams below each question.

(2) The figures should be neat and approximately correct: absolute accuracy is not required.
(3) Ruler and compasses are the only instruments to be used.
(4) All construction lines should be clearly shown.
(5) No written statement is necessary in this part of the paper.
(6) In drawing parallel lines use your eye and the ruler; in other constructions show all construction lines.

1. Bisect this angle.

2. Draw the right bisector of this line.

3. Construct a rectangle equal in area to this triangle.

4. Construct a triangle equal in area to this polygon.

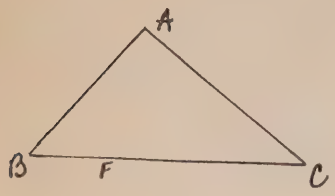
5. Find the centre of the circle of which the arc below is a part.

6. Draw tangents from P to this circle.

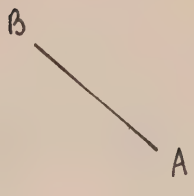
7. Cut off 3/7 of this line.

8 Find a line which will be a mean proportional between these two lines.

9. Draw a line parallel to BC so that the part between AB and AC may equal BF.



10. Draw a perpendicular to AB at A without producing AB.



11. From the quadrilateral, cut off a part similar to it and $= 4/9$ of its area.

12. Draw a transverse common tangent to these circles.

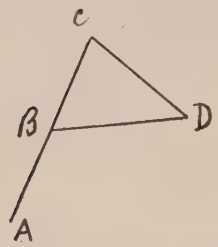
13. The radius of this circle is $1\frac{1}{4}$ inches. Place in it a chord 2 inches long and calculate its distance from the centre.

14. Draw a straight line $\sqrt{8}$ inches long.

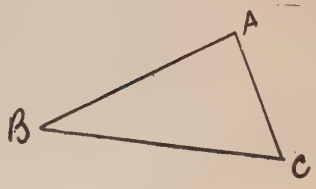
B. *Constructions required to prove theorems:*

See the instructions under section A. Lines or angles made equal should be so marked on the figure. No proof is required.

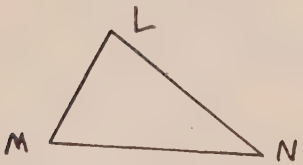
1. Make the construction that will prove angle ABD greater than angle BDC.



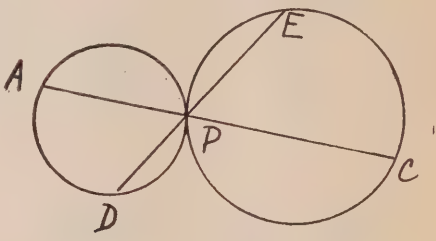
2. If BC is greater than AC then the angle A is greater than the angle B.



3. $ML+MN$ is greater than LN.



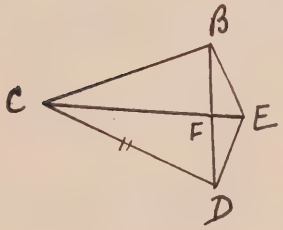
4. The circles touch at P to prove AD parallel to EC.



C. *Proofs of theorems:*

NOTE: Pupil will make on the figure any construction necessary and will write the proof only, in as concise a form as possible.

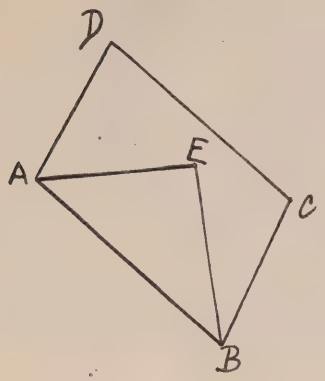
Example: In the figure below $BC=DC$ and $BE=DE$, prove CE the right bisector of BD.



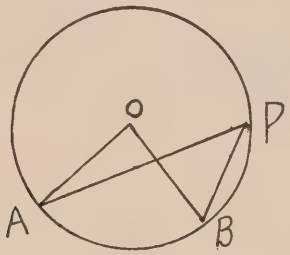
Proof

In $\triangle$s BCE and CDE
$BC=CD$
$BE=ED$
$CE=CE$
$\therefore \angle BCE=\angle ECD.$
In $\triangle$s BCF and DCF
$BC=CD$
$CF=CF$
$\angle BCF=DCF$
$\therefore BF=FD$ and $\angle BFC=DFC=1$ Rt.$\angle$

C. 1. AE and BE bisect the angles A and B of the parallelogram. Prove angle AEB = right angle.

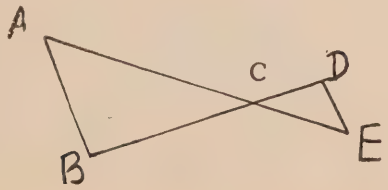


2. Prove that angle AOB is double the angle APB. Given O the centre and P on the circumference.

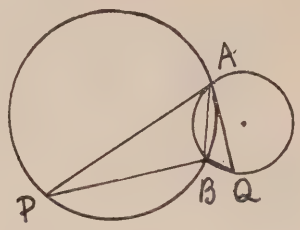


3. Given DE parallel to AB.

Prove $\frac{AE}{CE} = \frac{BD}{CD}$



4. AP is a tangent to the circle ABQ and AQ is a tangent to the circle ABP. Prove angle ABP = angle ABQ.



D. *Numerical calculations:*

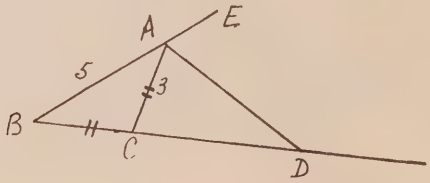
1. How many degrees are there in one of the interior angles of a regular eight sided figure?
2. The exterior angle made by producing one side of a regular polygon is 20°. How many sides has it?

3. If you were asked to draw triangles
   (A) 3″ 6″, 9″
   (B) 4″, 5″, 6″
   (C) 5″, 6″, 8″
   (D) 15″, 36″, 39″

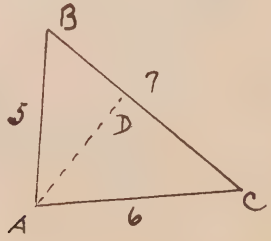
   Which of these would be..... (Place A, B, C, or D opposite).

   1. A right angled triangle ? ( )
   2. An acute angled triangle? ( )
   3. An obtuse angle triangle? ( )
   4. Not a triangle. ( )

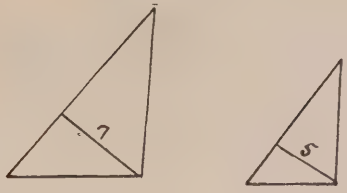
4. In triangle ABC side $CB = CA$ and AD bisects the angle CAE. Also $AC = 3$ and $AB = 5$. Find CD.



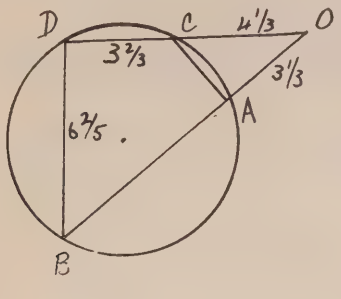
5. In triangle ABC, $AB = 5$, $AC = 6$ and $BC = 7$. AD is at right angles to BC. Find BD and CD.



6. In these similar triangles the perpendiculars are as 7:5. What is the ratio of the areas?



7. Two straight lines OAB and OCD cut a circle. Given that $OA = 3\ \frac{1}{3}$ $OC = 4\ \frac{1}{3}$ $CD = 3\ \frac{2}{3}$ and $BD = 6\frac{2}{5}$. Find OB and AC.



$OB =$
$AC =$

School .....

Candidate .....

MIDDLE SCHOOL LATIN

Time: 3 hours

1. Translate into English:

Aeolus haec contra: 'Tuus, o regina, quid optes
explorare labor; mihi iussa capessere fas est.
tu mihi quodcumque hoc regni, tu sceptra Iovemque
concilias, tu das epulis accumbere divum,
nimborumque facis tempestatumque potentem.'

(*a*) *regina:* who?

(*b*) Name and account for the case of *regni* (3), *epulis* (4), *nimborumque* (5), *potentem* (5); account for the mood of *optes* (1).

2. Translate into English:

hic Caesar et omnis Iuli
progenies, magnum caeli ventura sub axem.
hic vir, hic est, tibi quem promitti saepius audis
Augustus Caesar, Divi genus, aurea condet
(5) saecula qui rursus Latio regnata per arva
Saturno quondam, super et Garamantas et Indos
proferet imperium; iacet extra sidera tellus
extra anni solisque vias, ubi caelifer Atlas
axem umero torquet stellis ardentibus aptum.

(10) huius in adventum iam nunc et Caspia regna
responsis horrent divum et Maeotia tellus,
et septemgemini turbant trepida ostia Nili.

(*a*) What is the reference in *Caesar* (1), *Atlas* (8), *Maeotia* (11)?

(*b*) Write out and scan lines 7, 9, 11, marking the quantity of each foot, including the last in each line.

(*c*) Where were these lines spoken? By whom? To whom?

(*d*) What is the main thought of this passage?

3. Do not translate the following passage: answer the syntax questions only:

Qua re nuntiata Pirustae legatos ad eum mittunt qui doceant nihil earum rerum publico factum consilio; seseque paratos esse demonstrant omnibus, rationibus de iniuriis satisfacere. Percepta oratione eorum, Caesar obsides imperat eosque ad certam diem adduci iubet; nisi ita fecerint, sese bello civitatem persecuturum demonstrat.

Name and explain the use of the case of *consilio* (2), *bello* (4); account for the mood and tense of *doceant* (1) *fecerint* (4).

4. Write the Latin required to complete the following sentences:

(*a*) He points out what he wants done:
Quid fieri.....ostendit.

(*b*) Along with the rest was Dumnorix, the Aeduan, of whom mention has already been made by us:
Erat una.....Dumnorix Aeduus, de quo ante.....
dictum est.

(*c*) In order that he might not be able to do the state any injury:
Ne.....nocere posset.

(*d*) He repeatedly shouts that he is free and from a free state:
Saepe clamitat se.....et.....esse.

(*e*) As they had been ordered, they surround the man:
Illi, ut.....circumsistunt hominem.

(*f*) Three thousand cavalry were left to guard the ships:
Tria milia.....sunt relicta qui.....essent.

(*g*) Ireland is a half smaller than Britain:
Hibernia.....minor est quam.....

(*h*) Three days afterwards the enemy took up a position on the hills:
.....hostes.....constiterunt.

(*i*) Caesar sent three legions to forage (use gerund or gerundive).
Caesar.....tres legiones misit.

(*j*) This river can be crossed in only one place on foot:
Hoc flumen.....pedibus.....potest.

(*k*) With such speed did the soldiers advance, though only their heads were above water, that the enemy were not able to withstand their attack:
.....milites ierunt, cum.....ex aqua
exstarent, hostes impetum.....

(*l*) They fled:
Mandabant.....

(*m*) He learned we were going to march in this direction:
Nos iter.....cognoverat.

(*n*) They ask that he send into their state Mandubracius to assume control:
Petunt.....in civitatem Mandubracius qui imperium.....

(*o*) While these things are taking place, Caesar sends messengers to his troops and orders them to make a surprise attack:
Caesar dum haec.....ad milites nuntios
mittit et imperat.....de improviso.....

(*p*) It so happened that not a single transport was lost:
Sic accidit ut nulla omnino navis.....

5. Translate at sight:

Adventu Fabii nuntiato L. Plancus, qui legionibus preerat, necessaria re coactus, locum capit superiorem diversamque aciem in duas partes constituit, ne ab equitatu circumveniri posset. Ita congressus impari numero magnos impetus legionum equitatusque sustinet. Commisso ab equitibus proelio signa legionum duarum procul ab utrisque conspiciuntur, quas C. Fabius ponte subsidio nostris miserat, arbitratus fore ut duces adversariorum occasione et beneficio fortunae ad nostros opprimendos uterentur. Quibus rebus proelio interrupto suas uterque legiones reducit in castra. (*Diversus:* facing; *congredior:* fight).

6. Translate into Latin:
   (*a*) If Caesar had stayed a few days longer at Rome, he would have been victorious.
   (*b*) Let us await his arrival. We shall not then return home too late, shall we?
   (*c*) He persuaded his fellow-citizens not to surrender to the Romans.
   (*d*) I am afraid that I shall not be able to overtake the cavalry before daybreak.
   (*e*) When they were on the point of setting out for Gaul, they heard that the chieftains had already surrendered.
7. The next day early in the morning Caesar sent out the infantry and the cavalry to pursue those who had fled. When these had proceeded a considerable distance and could already see the rearguard of the enemy, cavalrymen came from Quintus Atrius to Caesar to report that on the previous night a severe storm had arisen and almost all the ships had been beached because the anchors could not hold (subsisto) and the sailors could not stand the violence of the hurricane. So, as a result of the collision of the ships, great damage had been done.

MIDDLE SCHOOL PHYSICS

Time 2½ hours

Part A

Directions:

Place a plus sign (+) in the brackets at the right of each true statement and a zero (0) at the right of each false statement.

Avoid marking statements concerning which you know nothing at all. Avoid pure guesses.

You will be given 2 hours and 30 minutes to complete the three parts A, B and C of this examination. When you have finished one part proceed at once to the next.

Use a soft lead pencil.

Examples:

Air contracts when heated.....(0)
Wood transmits sound.....(+)

1. Sound waves are always longitudinal.....( )
2. The period of vibration of a pendulum is decreased if the length of the pendulum is increased.....( )
3. A vibration in which the motion is across the length of the vibrating body is called a transverse vibration.....( )

4. When a tuning fork is emitting sound both prongs vibrate transversely ( )
5. If a violin string is vibrated the portion of the string at the bridge is a loop ( )
6. A bell sounding in a closed vessel is heard more clearly as air is gradually exhausted from the vessel ( )
7. The intensity of a sound varies inversely as the distance from the source ( )
8. The velocity of sound in air becomes less as the temperature rises ( )
9. A note whose frequency is five times that of a given note is called a harmonic of the given note ( )
10. The pitch of a note depends on the amplitude of the vibration ( )
11. The number of vibrations of a string per second is inversely proportional to the diameter of the string ( )
12. Resonators are used to determine the overtones of a note ( )
13. If a narrow closed tube is giving its fundamental note the wave-length of the note is four times the length of the tube ( )
14. In a closed pipe all the overtones may be produced ( )
15. Sympathetic vibrations may be illustrated by the use of two tuning forks of the same frequency ( )
16. The quality of a note depends on the presence of certain overtones ( )
17. Sound waves of the same frequency but of different amplitudes travel at the same speed ( )
18. A careful observer can detect beats in the sounds received from a source and its echo ( )
19. If a compound bar made by rivetting together strips of copper and iron be heated uniformly it bends into a curved form with the copper on the concave side ( )
20. If a compressed gas be allowed to expand its temperature falls ( )
21. Whenever heat is produced it is transformed from another form of energy ( )
22. If a flask containing air is gently heated and then quickly inverted with its neck under water, bubbles of air will be observed to escape from the flask ( )
23. As a rule liquids expand more than solids for the same rise in temperature ( )
24. In winter the coldest water in a lake is found near the bottom ( )
25. In an experiment to illustrate Charles' Law the volume of the gas is kept constant ( )
26. An interval of 180 degrees on the Fahrenheit scale is equal to an interval of 100 degrees on the Centigrade scale ( )
27. A calorie is the amount of heat required to raise one gram of any substance one Centigrade degree in temperature ( )
28. To convert 10 grams of ice at 0 C. into water at 1 C. requires 90 calories of heat ( )

[Latent heat of fusion of ice = 80 calories]

29. Two bodies may be at the same temperature but contain different quantities of heat ( )
30. Water has a greater capacity for heat than land ( )
31. A B.T.U. is the quantity of heat required to raise one pound of water one Fahrenheit degree in temperature ( )
32. The thermal capacity of a body depends on its temperature ( )
33. Amorphous bodies have a sharply defined melting point ( )

34. If a body contracts on melting, its melting point will be lowered by pressure.....( )
35. When water freezes heat is set free.....( )
36. Metals which contract on solidification give the best castings.....( )
37. The boiling point of a liquid depends on the pressure.....( )
38. The dew point is that temperature at which the amount of water vapour actually present in the air is sufficient to saturate it.....( )
39. The difference between the readings on the thermometers of a Wet-and-Dry-Bulb hygrometer is less on a day when the air is dry than on a day when it is nearly saturated with water vapour.....( )
40. Cold air entering a warm room has its relative humidity immediately increased.....( )
41. Convection phenomena are found only in liquids and gases.....( )
42. Light, freshly fallen snow is a good conductor of heat.....( )
43. Wool feels warmer to the touch than iron at the same temperature on account of the difference in their colour.....( )
44. Some material medium is necessary for the transmission of light....( )
45. A pin-hole image is always the same size as the object acting as the source of light.....( )
46. If the source of light is very small the shadow produced by an opaque object has a large pen-umbra.....( )
47. An eclipse of the sun is produced when the shadow of the moon reaches the earth.....( )
48. A 16-candle power lamp at a distance of 4 feet gives the same intensity of illumination as a one-candle power lamp at a distance of one foot..( )
49. We cannot see an object unless light comes to us from it.....( )
50. Light is transmitted by means of longitudinal waves.....( )
51. In a plane mirror the image is always laterally inverted.....( )
52. When light is reflected from a spherical mirror the angle of incidence always equals the angle of reflection.....( )
53. An object is placed between the reflecting surfaces of two mirrors inclined at 60° to each other. Only three images are seen.....( )
54. The angle of incidence is the angle between the incident and reflected rays.....( )
55. A candle placed 10 cm. in front of a concave mirror of focal length 25 cms. gives a virtual image.....( )
56. An object at the centre of curvature of a concave mirror will have an image at the principal focus.....( )
57. A real image may always be caught on a screen.....( )
58. A concave mirror sometimes gives a real image larger than the object..( )
59. When light passes obliquely from a denser to a rarer medium the angle of incidence is less than the angle of refraction.....( )
60. The index of refraction for given materials depends on the angle of incidence.....( )
61. Light entering a glass prism obliquely is always bent towards the base of the prism.....( )
62. A beam of parallel light on passing through a convex lens is brought to a focus at a distance of two focal lengths.....( )
63. Because light travels at the rate of 186,000 miles per second in air, and 124,000 miles per second in glass, the index of refraction from air to glass is $\frac{186,000}{124,000}$.....( )

64. A convex lens of focal length 10 inches is placed 15 inches from a candle. An image of the candle cannot be obtained on a screen....( )
65. In using a convex lens as a magnifying glass the lens is placed at more than one focal length from the object.....( )
66. The lens in a simple camera produces a real image on the film or plate.....( )
67. A ribbon of spectrum blue is held in the red portion of the spectrum of white light in a darkened room. The ribbon appears to be black..( )
68. Half a disc is red in colour and the other half is painted with the complementary colour. When rapidly rotated the disc appears black.....( )
69. A piece of soft iron in the vicinity of a permanent magnet possesses magnetic poles.....( )
70. A permanent magnet is broken into two pieces. Each portion has only one magnetic pole.....( )
71. Two insulated pith balls charged with the same rod will attract one another when brought near together.....( )
72. Electrical charges tend to concentrate at points on a conductor.....( )
73. The di-electric in an electrical condenser is always a conductor of electricity.....( )
74. A voltaic cell always consists of at least two plates of different materials immersed in a liquid conductor of electricity.....( )
75. A wire carrying an electric current placed over a compass needle always turns the N-seeking pole of the needle towards the west.....( )
76. In a dry cell the hydrogen is used up by the carbon granules.....( )
77. In a given conductor the greater the difference in potential between two points, the greater is the resistance.....( )
78. When a current is passed from one metal plate to another through a solution of copper sulphate, copper is deposited on the cathode.....( )
79. The strength of a current in amperes may be determined by using a copper voltameter.....( )
80. When a storage battery is being charged the sulphuric acid in the cell decreases.....( )
81. The more current passes through the coils of an electro-magnet the stronger becomes the magnet.....( )
82. The purpose of a soft iron core in an electro-magnet is to get more current through the coils.....( )
83. On looking at the North seeking pole of an electro-magnet the current is seen to pass in a contra-clockwise direction.....( )
84. The wire used in constructing an electro-magnet must be covered with some good insulating material.....( )
85. In a D'Arsonval galvanometer the coil is adjusted so that it can turn easily.....( )
86. The armature of an electric bell is made of brass.....( )
87. The current of electricity is continuous as long as the bell keeps ringing.....( )
88. An alternating current must be used to produce the sound in a telegraph sounder.....( )
89. The resistance of an ordinary lamp filament depends upon the direction of the current in the filament.....( )
90. Incandescent lamps in house circuits are usually connected in parallel ( )
91. In an electric iron the filament is made of pure iron.....( )

92. The magnetic field about a conductor exists only when the current is changing.....( )
93. If an electric current is reversed in direction the accompanying magnetic field is also reversed in direction.....( )
94. An induced current is necessarily in the same direction as the primary current.....( )
95. It is possible to move a coil of wire in a uniform magnetic field without inducing an electro-motive force.....( )
96. A lamp of 240 ohms resistance takes one-half ampere if the difference in potential between its terminals is 120 volts.....( )
97. The dial of a voltmeter is usually calibrated to read ohms.....( )
98. Electric waves travel at the same rate as light waves.....( )
99. A current of 3 amperes and an E.M.F. of 2 volts can do work at the rate of 5 watts.....( )
100. A voltmeter is always connected in series in a circuit.....( )

Part B

Directions:

Fill in each blank with the word or words which make the statement true.

Example: transversely.

A violin string emitting a note vibrates.....

1. When the vibrations are in the same direction as the length of the vibrating body they are said to be.....
2. The sound of a gun 2,604 feet distant was heard 2 and 2/5 seconds after the flash was seen. The velocity of sound in air is.....feet per second. (You may do your calculation in the space below. Only the answer will be marked).
3. Waves caused by continual interference between direct and reflected waves are called.....waves.
4. There are three features by which sounds may be distinguished from one another (1) intensity, (2) quality, (3).....
5. The number of vibrations per second of a string varies.....as its length.
6. A sonometer string was first stretched by a weight of 10 lbs. and later by one of 40 lbs. The frequency of the first note is to that of the second as 1 is to.....
7. The fundamental note in a closed pipe 6 inches long has four times the frequency of the fundamental note in an open pipe....inches long.
8. When an air column vibrates in unison with a tuning-fork the resultant increase in intensity is called.....
9. One note has a frequency of 256 vibrations per second, another has one of 258 vibrations per second. When sounded together the number of beats heard per second is.....
10. A plate sprinkled lightly with sand is bowed. The lines along which the sand collects are called.....
11. In wave-motion, particles which are at the same stage of the movement at the same time are said to be in the.....
12. If in a thermometer a liquid were used which wets the tube, the instrument would read too.....when the temperature is falling.
13. A certain mass of gas is at a temperature of 20°C. Under the same pressure it would occupy double the volume at.....°C.

14. Ten grams of brass were heated through 1°C. The quantity of heat gained by the brass is.....calories.
(Specific heat of brass = .09)
15. The amount of heat required to convert 10 grams of ice at −20°C. to steam at 100° C. is.....calories.
[Specific heat of ice = .5. Latent heat of fusion of ice = 80 calories.
Latent heat of vaporization of water = 536 calories.]
16. Air is said to be saturated with water vapour when any drop in temperture causes.....to take place.
17. The temperature at which a liquid gives off bubbles of its own vapour is called its.....
18. A beaker containing a small amount of ether is placed on a little water lying on the bench top. If air is bubbled rapidly through the ether, it will be found that the water has.....
19. To make ice melt at −2°C., it would be necessary to.....the pressure on it.
20. If the relative humidity is high on a hot day we feel uncomfortable because.....from the body is reduced.
21. If the dew-point is the same as air temperature the relative humidity is.....per cent.
22. If there are no disturbing forces during summer months a breeze from the sea is likely to blow over the land during the.....
23. A polished surface is a.....radiator.
24. The intensity of illumination at 9 feet from a source of light is..... times that at 4 feet.
25. If a grease-spot photometer is held behind a lamp the grease-spot appears.....than the other portion.
26. The length of the smallest plane mirror in which a man 6 feet high standing erect can see himself completely is.....feet.
27. The radius of curvature of a spherical mirror is approximately double.....
28. In a convex mirror the image is always.....than the object.
29. Virtual images are obtained with a concave mirror when the object is placed.....
30. The index of refraction from air to crown glass is 1.5, that from crown glass into air is.....
31. If a ray of light travelling in any medium meets the common surface of this and an optically less dense medium at an angle less than the critical angle.....takes place.
32. If a ray of light enters a glass prism and is refracted out again the angle between the incident and emergent ray is called.....
33. If a ray of light meets the surface of separation of two media perpendicularly, the angle between the original and final directions of the ray measures.....degrees.
34. An erect image may be obtained with a convex lens if the object be placed.....
35. In the projection lantern it is necessary to place the slide at a distance between.....and.....from the projecting lens.
36. In a bar magnet the lines of force enter at the.....pole and emerge from the.....pole.

37. A soft iron bar standing in a vertical position in the northern hemisphere becomes magnetized so that the lower end acts as a.....seeking pole.
38. A negatively charged rod is brought near an electroscope, the leaves of which are not charged. The leaves become charged with..... electricity. The knob of the electroscope is touched with the hand which is then withdrawn. The ebonite rod is then removed. The leaves now .....because they are charged with.....electricity.
39. When an electric current is passed through dilute sulphuric acid .....is liberated at the.....and oxygen at the.....
40. In a gravity cell.....collects on the copper plate.
41. The copper plate in a simple voltaic cell is replaced by carbon. The current becomes.....because the difference in potential between zinc and copper is.....than that between zinc and carbon.
42. If a storage battery is fully charged the holes in the anode are filled with.....while those in the cathode contain .....
43. In the D.C. motor a current of electricity passes through the..... .....and the....., each of which becomes a magnet. The motor converts.....energy into .....energy.
44. In a step-up transformer the current which emerges is.....than the current entering. The voltage of the former is..... than that of the latter.
45. The current which deposits silver at the rate of .002236 gms. per second is.....amperes. (The electro-chemical equivalent of silver is .001118 gms.)

Part C

Directions:

Figure 1 represents an apparatus used in determining the latent heat of vaporization of water. In dealing with statements 1 to 11 refer to this diagram.

Figure 2 illustrates an apparatus used in comparing two sources of light. Refer to this diagram when dealing with statements 12 to 19.

Place a plus sign (+) in the brackets at the right of each true statement and a zero (0) at the right of each false statement. Avoid pure guesses.

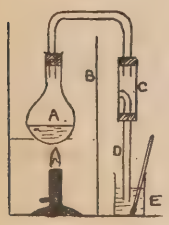


Fig. 1

1. The beaker E should be placed as shown in the diagram as soon as heat is applied to A.....( )
2. The mass of steam condensed is obtained by weighing A before and after the experiment.....( )
3. The screen B is used to prevent heat from the burner affecting the temperature of the water in E.....( )
4. The portion C is employed to trap any water caused by the condensation of steam.....( )
5. It is advisable to have the tube D as long as possible.....( )

6. It is better to introduce a small weight of steam into E than a large amount.....( )
7. The openings of the two tubes leading into C should be directly opposite each other.....( )
8. When sufficient steam has been passed into E the source of heat should be removed before D is taken out of E.....( )
9. The upper end of the tube D should be well above the lower cork in C, as in the diagram.....( )
10. A small error in the weight of the steam has a serious effect on the final result.....( )
11. The steam should be passed into E as slowly as possible.....( )

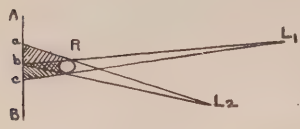


Fig. 2

12. The portion a b is illuminated by L_1...( )
13. If the screen AB is made of thick white paper the observer should be on the side of AB opposite to the sources of light...( )

14. L_1 and L_2 are moved about until the portions ab and bc are equally dark..( )
15. If AB be moved farther to the left a portion of the screen between the two shadows will not receive illumination from either L_1 or L_2.....( )
16. The stronger source of light will be at the greater distance from the screen ( )
17. The perpendicular distances from L_1 and L_2 to the screen are required..( )
18. The rod R is best made of transparent material.....( )
19. Even if you are careful it is difficult to find exactly the proper positions of L_1 and L_2.....( )

Directions:

In Questions 20, 21 and 22, fill in each blank with the word or words which make the statements correct.

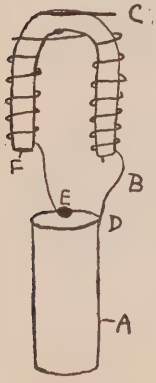


Figure 3

20. In Figure 3, A is a dry cell, connected as shown by an insulated copper wire B which passes around a piece of soft iron C. In the copper wire the current passes from the point marked by the letter....to the point marked by.... The end of the soft iron marked F becomes a.....magnetic pole. If the observer faces the pole G the current appears to pass around the soft iron in a.....direction.

21. Figure 4, A and C are the plates of a simple voltaic cell and B is the electrolyte. A current of electricity passes in the direction indicated by the arrow E in a conductor D. This wire has been placed above and parallel to a compass needle which, before the circuit was completed, has its North pole pointed in the direction indicated by the arrow N.

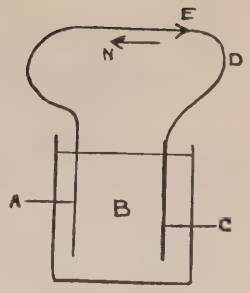


Figure 4

Plate A is made of.....
Plate C is made of.....
The electrolyte B is composed of.....
The weight of the plate C gradually becomes.....
The pole N turns.....the observer.

The cell becomes polarized because the plate marked by the letter..... becomes coated with..... Local action is prevented by coating the plate composed of.....with.....

22. Figure 5, BC is an iron wire, V a voltmeter, A an ammeter, D a battery. You are also provided with some thick copper wire.

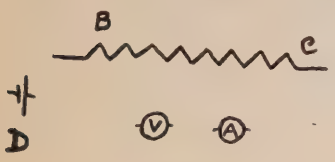


Figure 5

(*a*) Complete the connection necessary to measure the potential difference between B and C and the current passing from B to C. (Use Figure 5 for this).

(*b*) The voltmeter has a.....resistance than the ammeter.

(*c*) If the ammeter indicates 8 amperes and the voltmeter 24 volts the resistance of the wire BC is.....ohms.

Department of Education, Ontario

ANNUAL EXAMINATIONS, 1930

MIDDLE SCHOOL ALGEBRA

1. Find all the factors of:—
   (*a*) $3ab^3-24a^4$.
   (*b*) $18a^2b^2=57ab^2+45b^2$.

2. (*a*) Simplify $\left(1-\frac{8x}{x^2+4x+3}\right)\left(2+\frac{8}{x-1}\right)\div\left(3+\frac{6}{x-5}\right)$

   (*b*) Solve $\frac{2}{3}(x-1)-\frac{2}{5}(4x-5)=3-\frac{7x+5}{10}$.

3. A man loans c dollars, part of it at a per cent. and the balance at b per cent. He finds that his income from each loan is the same. How many dollars did he loan in each case?

4. Solve the equations:—

$$x-3y+z=2,$$
$$2x+y-2z=3,$$
$$4x-2y-3z=4.$$

5. (*a*) Using ½ inch for the unit of measurement, represent graphically the equations $x-3y+5=0$, $2x+y+3=0$.

(*b*) Find the co-ordinates of the point of intersection of the graphs in (*a*) and show that this point is on the graph of $3x-2y+8=0$.

6. Find the square root of $25x^{\frac{4}{5}}-30x^{\frac{3}{5}}+49-24x^{-\frac{2}{5}}+16x^{-\frac{4}{5}}$.

7. Solve the equations:—

$$x^2+y^2=5,$$
$$y^2-xy=3.$$

8. (*a*) Without using a formula, solve the equation

$$bx^2-ax+c=0.$$

(*b*) If m and n are the roots of the equation

$$2x^2+7x-5=0,$$

construct the equation whose roots are $m+2n$ and $2m+n$.

9. A man spent $90 for coal, and found that, had the price per ton been $1.50 higher, the amount of coal purchased would have been two tons less. What price per ton did the man pay?

10. The perimeter of a right-angled triangle is five times the length of the shortest side. Find the ratio of the lengths of the sides about the right angle.

Department of Education, Ontario

ANNUAL EXAMINATIONS, 1930

MIDDLE SCHOOL CANADIAN HISTORY

NOTE.—*Five questions constitute a full paper, one from A, two from B, and two from C.*

A

NOTE.—*Candidates will take question 1 or question 2, but not both.*

1. (*a*) Give the location of the following: Annapolis, Lundy's Lane, Ticonderoga, Fort Frontenac, Newark.

(*b*) By reference to historical facts explain why each of these is of importance in Canadian history.

2. (*a*) Define the following municipal divisions: (i) township, (ii) village, (iii) town, (iv) city.

(*b*) State (i) the method of selection and (ii) the duties of each of the following: reeve, warden, mayor, police magistrate.

(*c*) Specify *four* purposes for which taxes are collected in a town or city.

B

NOTE.—*Only two questions are to be attempted. If a candidate writes on the three questions of B, only the first two attempted will be valued.*

3.(*a*) Tell the story of the explorations of Joliet, Marquette, and La Salle.

(*b*) In what circumstances and by what treaty did the regions they explored pass from French control?

4. Describe the life of New France under the following headings:—

(*a*) Form of government.
(*b*) The seigniorial system.
(*c*) The missionaries.

5. (*a*) State the circumstances under which the Loyalists came to Canada.

(*b*) What new problems of government arose with the coming of the Loyalists?

(*c*) Give the provisions of the Act which was designed to solve these problems.

(*d*) What problems did this Act create or leave unsolved?

NOTE.—*Only two questions are to be attempted. If a candidate writes on the three questions of C, only the first two attempted will be valued.*

6. Explain the following, showing why they are important in Canadian history:—

(*a*) The Ashburton Treaty.
(*b*) The Rebellion Losses Bill.
(*c*) The repeal of the Navigation Acts.
(*d*) The Reciprocity Treaty, 1854.

7. (*a*) Sketch the career of Sir John A. Macdonald before he became Prime Minister of Canada.

(*b*) Describe the policy of the government under him with regard to:—

(i) The discontent of the Maritime provinces with Confederation.
(ii) The fisheries question.
(iii) Railways.
(iv) The tariff.

8. (*a*) Sketch the career of Sir Wilfred Laurier until he became Prime Minister of Canada.

(*b*) Describe the policy of his administration with regard to:

(i) Relations with Great Britain.
(ii) Relations with the United States.
(iii) Immigration.

Department of Education, Ontario

ANNUAL EXAMINATIONS, 1930

MIDDLE SCHOOL CHEMISTRY

1. The following is a list of laboratory experiments:—
   (*a*) Magnesium is strongly heated in an open crucible.
   (*b*) Marble is strongly heated in an open crucible.
   (*c*) A mixture of manganese dioxide and potassium chlorate is heated in a test-tube.
   (*d*) A mixture of manganese dioxide and hydrochloric acid is heated in a test-tube.
   (*e*) A piece of calcium is dropped into water.
   (*f*) A piece of calcium carbide is dropped into water.
   (*g*) Zinc is placed in a mixture of sulphuric acid and water.
   (*h*) Copper is strongly heated with concentrated sulphuric acid.
   (i) In each of the above experiments name the new substance or substances produced.
   (ii) In each of (*a*), (*d*), and (*e*), state one result observed.
   (iii) Write equations for the reactions in (*c*), (*d*), and (*f*).

2. (*a*) What is meant by the *solubility* of a salt in water?
   (*b*) What effect has the powdering of a solid on its rate of solution? Why?
   (*c*) What is the most effective method of increasing the solubility of a gas in a liquid?

3. You are required to collect (*a*) a jar of carbon monoxide, (*b*) a jar of ammonia. Show by labelled diagrams the materials, apparatus, and methods used. Write equations for each of the two reactions.

4. Write the formulae for the following: potassium chlorite, sodium perchlorate, Chile saltpetre, and methane.

5. ·079 gram of magnesium placed in dilute sulphuric acid yielded 80 cubic centimetres of hydrogen gas measured in a tube inverted over mercury. The level of the mercury in the tube was 12 millimetres higher than the level of the mercury in the dish. The temperature of the room was 17°C. and the atmospheric pressure 757 mm. of mercury.
   (*a*) Calculate the volume of this hydrogen at 0°C. and 760 mm. pressure.
   (*b*) What would this hydrogen weigh, given that 1 litre of hydrogen at normal temperature and pressure weighs ·09?
   (*c*) From these results obtain the chemical equivalent (combining weight) of magnesium.

6. State one use for each of the following: chlorine, carbon dioxide, saltpetre, ammonia.

7. Explain briefly each of the following statements:—
   (*a*) The valency of magnesium is 2.
   (*b*) Carbon has several allotropic forms.
   (*c*) Sodium oxide is a basic oxide.
   (*d*) The reaction which occurs when water drops on quicklime is exothermic.

8. You know that a given colourless liquid is a solution in water of a chloride, a bromide, or an iodide. How would you ascertain experimentally which one of the three it is?

9. (*a*) Any sample of carbon dioxide consists of 27·27% carbon and 72·72% oxygen by weight.

Name and state the law illustrated by this statement.

(*b*) Carbon monoxide consists of 42·857% carbon and 57·143% oxygen. Show that (*a*) and (*b*) together illustrate the law of multiple proportions.

Department of Education, Ontario

ANNUAL EXAMINATIONS, 1930

MIDDLE SCHOOL FRENCH AUTHORS, GRAMMAR, AND SIGHT TRANSLATION

A

1. Translate into English:—

Il lui jeta sur les épaules les vêtements qu'il avait apportés pour la sortie, modestes vêtements de la vie ordinaire, dont la pauvreté jurait avec l'élégance de la toilette de bal. Elle le sentit et voulut s'enfuir, pour ne pas être remarquée par les autres femmes qui s'enveloppaient de riches fourrures.

Loisel la retenait:

—Attends donc. Tu vas attraper froid dehors. Je vais appeler un fiacre.

Mais elle ne l'écoutait point et descendait rapidement l'escalier. Lorsqu'ils furent dans la rue, ils ne trouvèrent pas de voiture; et ils se mirent à chercher, criant après les cochers qu'ils voyaient passer de loin.

Ils descendaient vers la Seine, désespérés, grelottants. Enfin ils trouvèrent sur le quai un de ces vieux coupés noctambules qu'on ne voit dans Paris que la nuit venue, comme s'ils eussent été honteux de leur misère pendant le jour.

2. (*a*) Write the third person singular, present indicative, of *jeta* (l. 1), *sentit* (l. 4), *voulut* (l. 4), *retenait* (l. 6), *appeler* (l. 8).

(*b*) Account for the form of *apportés* (l. 1).

(*c*) Write the past participle of *sentit* (l. 4), *retenait* (l. 6), *attends* (l. 7), *mirent* (l. 11).

(*d*) Write the third person plural, future, of *jeta* (l. 1), *voulut* (l. 4) *retenait* (l. 6), *appeler* (l. 8), *voyaient* (l. 12).

(*e*) *eussent* (l. 16). Write the third person singular of this tense.

B

3. Translate into English:—

Il se leva, marcha dans la chambre, s'approcha de la fenêtre, se versa un verre d'eau, et finit par s'arrêter en face de Louveau, les mains enfoncées dans sa ceinture.

Il cherchait une sentence qui s'appliquât à l'événement, et, comme il n'en trouvait pas, il dit simplement:

—Eh bien! mais il faut le rendre à son père.

Louveau tressaillit.

—Voilà justement mon ennui, monsieur le curé.

Depuis six mois que je sais ça, je n'ai eu le courage de rien dire à personne, pas même à ma femme.

Nous nous sommes donné tant de mal pour élever cet enfant-là: nous avons eu tant de misère ensemble, que, aujourd'hui, je ne sais plus comment je ferais pour m'en séparer.

4. (*a*) Write the third person singular, present, subjunctive, of *leva* (l. 1), *dit* (l. 5), *rendre* (l. 6), *sais* (l. 9), ferais (l. 13).

(*b*) *se leva* (l. 1). Write the first person plural, past indefinite, of this verb.
(*c*) Write the past indefinite and the future of *il faut* (l. 6).

C

5. Translate into English:—

PERRICHON.—Est-ce que vous ne perdrez pas l'habitude de vous fourrer à chaque instant dans ma vie?

ARMAND.—Comment?

PERRICHON.—Oui, vous touchez à tout! Qui est-ce qui vous a prié de faire arrêter le commandant? Sans vous, nous étions tous là-bas, à midi!

ARMAND.—Mais rien ne vous empêchait d'y être à deux heures.

PERRICHON.—Ce n'est pas la même chose.

ARMAND.—Pourquoi?

PERRICHON.—Vous me demandez pourquoi? Parce que...non! Vous ne saurez pas pourquoi! (*Avec colère.*) Assez de services, monsieur! assez de services! Désormais, si je tombe dans un trou, je vous prie de m'y laisser! j'aime mieux donner cent francs au guide... car ca coûte cent francs... il n'y a pas de quoi être si fier! Je vous prierai aussi de ne plus changer les heures de mes duels, et de me laisser aller en prison si c'est ma fantaisie.

6. (*a*) Write the third person singular, past definite, of *perdrez* (l. 1), *faire* (l. 5), *saurez* (l. 12), changer (l. 17).
(*b*) Write the plural of *monsieur* (l. 13), *trou* (l. 14).
(*c*) Write the feminine singular of *fier* (l. 16).

D

7. Translate into English:—

Nous avions couché dans un village assez misérable et nous en étions partis le matin au jour naissant. Longtemps nous avions marché sur une route couverte de poussière, lorsque tout à coup nos regards jusque-là enfermés dans un chemin que bordaient des vignes, s'étendirent librement sur un espace immense, comme si un rideau, touché par un bâton magique, avait subitement disparu devant nous.

Une large rivière coulait doucement autour de la colline sur laquelle nous venions d'arriver; et de l'autre côté de cette rivière les toits et les clochers d'une grande ville étaient dispersés çà et là jusqu'à l'horizon. Que de maisons! que de cheminées! Quelques-unes plus hautes et plus étroites, élancées comme des colonnes, vomissaient de la fumée noire qui, s'envolant au caprice de la brise, formait un nuage sombre. Sur la rivière, au milieu de son cours et le long d'une ligne de quais se trouvaient de nombreux navires comme les arbres d'une forêt. Leurs voiles et leurs drapeaux multicolores flottaient au vent.

Pour un enfant, élevé comme moi, qui n'avait vu que les pauvres villages ou les quelques petites villes que le hasard de la route nous avait fait rencontrer, c'était magnifique. Mes pieds s'arrêtèrent, je restai immobile, regardant devant moi.

Des navires, leurs voiles déployées, descendaient la rivière légèrement inclinés sur un côté, d'autres la remontaient; il y en avait qui restaient immobiles comme des îles, et il y en avait aussi qui tournaient sans qu'on vît ce qui les faisait tourner, enfin, il y en avait encore qui, avec une cheminée qui déroulait dans le ciel beaucoup de fumée, se mouvaient rapidement, laissant derrière eux, sur l'eau jaunâtre, des sillons d'écume blanche.

Puis, un soir, nous arrivâmes dans une grande ville, située au bord d'une rivière, au milieu d'une plaine fertile: les maisons, fort laides pour la plupart,

étaient construites en briques rouges; les rues étaient pavées de petits cailloux pointus, durs aux pieds des voyageurs qui avaient fait une dizaine de lieues dans leur journée.

E

8. Indicate, in some way, the pronunciation of: Louveau, chose, côté, verre, bois, ils parlent, hiver, dernier, service, monde.

Department of Education, Ontario

ANNUAL EXAMINATIONS, 1930

MIDDLE SCHOOL FRENCH COMPOSITION

NOTE.—*All numbers are to be written in words.*

A

Translate into French:—

1. Haven't you finished your work yet? I shall finish it before noon.
2. What is it that you are studying? I am studying the history of Canada. It is very interesting.
3. I have left all my books and pencils at home this morning.
4. Here is some money. Buy me some ink and a dozen pens.
5. You have too much paper. Give me some, for I have not enough.
6. My aunt is gone to the United States, where my uncle lives.
7. She spent three weeks in the country with us this summer.
8. Which of the two hats did she buy? The one she was trying on yesterday.
9. Sitting in front of the fire, we smoked and chatted a long time.
10. What time will the train arrive? At 8.45, if it is not late.
11. Do you know your French lesson to-day? I have learnt it by heart.
12. I am glad that you have told nobody what I told you.
13. I should like to borrow this chair, if you do not need it. Thanks very much.
14. My watch and John's are alike. An old friend gave them to us.
15. How much does he earn a month? Ninety dollars. That's very little.
16. Have you seen the beautiful big yellow flowers that he has in his garden?
17. The man to whom you spoke is the carpenter. It is he who built this house.
18. One cannot make omelets without breaking the eggs.
19. If it rains to-day we shall not be able to go and see the bears and the monkeys.
20. It is necessary for me to stay here, as I am waiting for someone. He is coming at two o'clock.

B

Translate into French:—

He goes out. They are coming. She is hiding. They would be able. I say. They do not wish (*use vouloir*). We are making. Do you not see? They know (use *savoir*). He ran (*past definite*).

C

Translate into French:—

(*a*) Armand saved Perrichon's life. That latter was falling into a crevasse when Armand came and pulled him out. Was Perrichon grateful? Not at all. He does not like anyone to do him a service. But later Perrichon himself had the great pleasure of saving someone. This is a thing that he will never forget. He talks about it always with joy. He does not know that Daniel had let himself slip into the crevasse on purpose.

(*b*) In the middle of the lake there is an island where one can find plenty of wood. One day my father told me to go and bring some wood for the fire. I was getting into the boat when my brother saw me. He shouted, "Wait a minute!" I replied, "I shall not wait." Then he got angry and threw stones at me. But I was already so far away that the stones could not touch me. "Very well, I will beat your dog," he said. Then I had to go back.

Department of Education, Ontario

ANNUAL EXAMINATIONS, 1930

MIDDLE SCHOOL GEOMETRY

A—THEOREMS

1. Straight lines which join the ends of two equal and parallel straight lines towards the same parts are themselves equal and parallel.

2. The area of a parallelogram is equal to that of a rectangle on the same base and of the same altitude.

3. If the angles of one triangle are respectively equal to the angles of another, the corresponding sides of the triangles are proportional.

4. The areas of similar triangles are proportional to the squares on corresponding sides.

5. DAC is an equilateral triangle; B is any point in AC produced through C. Show that the square on DB is equal to the sum of the squares on AC and CB together with the rectangle contained by AC and CB.

6. ABCD is a quadrilateral inscribed in a circle; the angle ABD is bisected by a straight line BE meeting the circumference in E. If the side AD is produced F, show that ED, produced if necessary, bisects the angle CDF.

B—PROBLEMS

(*Draw the figures, describe the method of construction, and give proofs*).

7. On a given straight line construct a segment containing an angle equal to a given angle.

8. Construct a parallelogram equal in area to a given rectilineal figure of five sides and having an angle equal to a given angle.

9. Construct a triangle ABC, having the angle ABC equal to a given angle, the base BC equal to a given straight line, and the sum of the sides AB, AC, equal to another given straight line.

C—Accurate Constructions

(Draw the figures accurately, using only ruler and compasses; show all construction lines but do not give proofs or descriptions of constructions).

10. (*a*) Construct a triangle ABC, having BC 5½ inches, the angle ABC 30°, and the angle ACB 67½°.

(*b*) Circumscribe a circle about the triangle ABC.

(*c*) Take any point P on the arc AB, and from P draw perpendiculars to the three sides of the triangle ABC, meeting BC, BA, CA (produced if necessary) in K, L, and M, respectively.

Department of Education, Ontario

Annual Examinations, 1930

MIDDLE SCHOOL PHYSICS

1. Describe experiments, one for each, to illustrate:—
   (*a*) Sympathetic vibrations.
   (*b*) The production of beats.

2. (*a*) A man fires a gun and 5½ seconds afterwards he hears the echo. The velocity of sound in the air is 1,120 feet per second. How far away is the reflecting surface?

(*b*) Describe an experimental method of determining the length of the wave produced in air by a tuning-fork.

3. (*a*) Describe experiments, one for each, to show:—
   (i) That solids do not all expand equally when heated.
   (ii) That some solids conduct heat more rapidly than others.
   (*b*) Give a practical application of each of the above facts.

4. (*a*) Explain the following statements:—
   (i) The specific heat of ice is 0.5.
   (ii) The heat of fusion of ice is 80.

(*b*) Using the information given in (*a*), calculate the number of calories of heat required to convert one kilogram of ice at a temperature of −40°C. into water at 90°C.

(*c*) Describe an experiment to determine the specific heat of a liquid.

5. (*a*) Using labelled diagrams to illustrate your answer, explain the meaning of the terms: index of refraction, critical angle, total reflection.

(*b*) Describe the grease-spot photometer, and show how it may be used to prove the law of intensity of illumination.

6. Make drawings to show:—
   (*a*) How a convex lens may be used as a simple microscope.
   (*b*) How a concave mirror may be used to form a magnified image of an object.

7. (*a*) Explain, with diagrams, the meaning of (i) induced magnetism, (ii) induced electrification, and (iii) induced current.

(*b*) Describe *either* a copper voltameter *or* a water voltameter, and show, with the aid of a diagram, how it can be used to test the graduations of an ammeter.

8. (*a*) Using a drawing to illustrate your answer, describe the construction of and induction coil (with condenser). Explain its operation.

(*b*) State a practical use for the induction coil.

9. (*a*) Describe an experimental method of measuring the electrical resistance of a conductor. Make a drawing showing the arrangement and connections of all apparatus used in the experiment. Determine the resistance of the unknown conductor from a supposed set of readings taken in your experiment.

(*b*) The E.M.F. of a bettery is 10 volts and the strength of the electric current, obtained through an external resistance of 4 ohms, is 1.25 amperes. What is the internal resistance of the battery?

Department of Education, Ontario

ANNUAL EXAMINATIONS, 1930

MIDDLE SCHOOL LATIN AUTHORS

A

1. Translate into English:—

(*a*) Insequitur clamorque virum stridorque rudentum.
eripiunt subito nubes caelumque diemque
Teucrorum ex oculis; ponto nox incubat atra.
intonuere poli, et crebris micat ignibus aether,
praesentemque viris intentant omnia mortem.

(*b*) Nox erat, et placidum carpebant fessa soporem
corpora per terras, silvaeque et saeva quierant
aequora, cum medio volvuntur sidera lapsu,
cum tacet omnis ager, pecudes pictaeque volucres,
quaeque lacus late liquidos, quaeque aspera dumis
rura tenent, somno positae sub nocte silenti.
at non infelix animi Phoenissa, nec umquam
solvitur in somnos, oculisve aut pectore noctem
accipit; ingeminant curae, rursusque resurgens
saevit amor, magnoque irarum fluctuat aestu.

(*c*) Ac veluti lentis Cyclopes fulmina massis
cum properant, alii taurinis follibus auras
accipiunt redduntque, alii stridentia tingunt
aera lacu; gemit impositis incudibus Aetna;
illi inter sese magna vi bracchia tollunt
in numerum, versantque tenaci forcipe ferrum:
non aliter, si parva licet componere magnis,
Cecropias innatus apes amor urget habendi,
munere quamque suo. grandaevis oppida curae
et munire favos et daedala fingere tecta.

2. Write out and divide into feet lines 4, 7, and 23, and mark the quantity of each syllable including the last syllable in each line.

3. (*a*) For conditions as described in 1 (*a*), who is directly responsible? Who is indirectly responsible?

(*b*) What is the reference in *Phoenissa* (l. 12), *Cyclopes* (l. 16), *Cecropias* (l. 23)?

(*c*) Contrast the general thought expressed in lines 6-11 with that expressed in lines 12-15.

B

NOTE.—*The following passages are* NOT *to be translated.*

(*a*) Nostri acriter in eos impetu facto reppulerunt neque finem sequendi fecerunt, quoad subsidio confisi equites, cum post se legiones viderent, praecipites hostes egerunt, magnoque eorum numero interfecto, neque sui colligendi neque consistendi aut ex essedis desiliendi facultatem dederunt.

(*b*) Quas cum aliquamdiu Caesar frustra exspectasset, ne anni tempore a navigatione excluderetur, quod aequinoctium suberat, necessario angustius milites collocavit ac summa tranquillitate consecuta, secunda inita cum solvisset vigilia, prima luce terram attigit omnesque incolumes naves perduxit.

(*c*) Sed ea celeritate atque eo impetu milites ierunt, cum capite solo ex aqua exstarent, ut hostes impetum legionum atque equitum sustinere non possent ripasque dimitterent ac se fugae mandarent.

4. Name and account for the case of *subsidio* (l. 2), *equites* (l. 2), *tempore* (l. 5), *vigilia* (l. 8), *capite* (l. 9); and account for the number of *colligendi* (l. 3).

5. Account for the mood of *viderent* (l. 2), *excluderetur* (l. 6), *possent* (l. 10).

6. Give the principal parts of *confisi* (l. 2), *egerunt* (l. 3), *desiliendi* (l. 4), *consecuta* (l. 7), *attigit* (l. 8), *ierunt* (l. 9).

7. Indicate the accented syllables in each of the following: *reppulerunt* (l. 1), *praecipites* (l. 2), *magnoque* (l. 3), *necessario* (l. 6), *tranquillitate* (l. 7), *mandarent* (l. 11).

C

8. Translate into English:—

(*Dispersal of Belgian contingents.*)

(*a*) Hostes, ubi nostros in locum iniquiorem non progredi pugnandi causa viderunt atque ipsos res frumentaria deficere coepit, concilio convocato, constituerunt optimum esse domum suam quemque reverti. Ea re constituta, secunda vigilia magno cum strepitu ac tumultu castris egressi sunt sic ut consimilis fugae profectio videretur. Hac re statim Caesar per speculatores cognita insidias veritus, quod qua de causa discederent nondum perspexerat, exercitum equitatumque castris continuit.

(*Crassus believes that conditions demand immediate action.*)

(*b*) Crassus ubi animadvertit suas copias propter exiguitatem omnes in partes eodem tempore non facile diduci posse, hostem et *vagari* et vias obsidere et castris satis praesidii relinquere, ob eam causam minus commode frumentum commeatumque sibi supportari, in dies hostium numerum augeri, non dubitandum existimavit quin pugnaret. Hac re ad consilium delata, ubi omnes idem sentire intellexit, posterum diem pugnae constituit.

vagari—to wander.

Department of Education, Ontario

ANNUAL EXAMINATIONS, 1930

MIDDLE SCHOOL LATIN COMPOSITION AND GRAMMAR

A

1. Write:—
   (*a*) The dative singular of *agger, cornu, iter, meridies, vir.*
   (*b*) The accusative singular of *custos, manus, pater, spes, vulnus.*
   (*c*) The genitive plural of *magister, passus, princeps, puer, vis.*
   (*d*) The ablative plural of *ager, exercitus, obses, tempus, res.*

2. Write:—
   (*a*) The third person singular of the future indicative of *discedo, vereor.*
   (*b*) The first person plural of the present subjunctive passive of *jubeo, mitto.*
   (*c*) The second person singular of the present imperative of *revertor, dico.*
   (*d*) The present infinitive passive of *capio, sentio.*
   (*e*) The dative plural of the perfect participle of *egredior, gero.*
   (*f*) The second person plural of the future perfect of *sto, possum.*
   (*g*) The third person plural of the present subjunctive of *moror, volo.*
   (*h*) The perfect infinitive active of *confero, dispono.*
   (*i*) The genitive of the gerund of *nanciscor, scribo.*
   (*j*) The first person singular of the perfect subjunctive of *cado, praesum.*

3. Write:—
   (*a*) The comparative of *creber, diu, magnopere, potens, utilis.*
   (*b*) The superlative of *acriter, audax, facile, malus, parum.*

4. Write the forms of:—
   (*a*) *hic* to agree with *aetate, nautus.*
   (*b*) *idem* to agree with *noctium, onere.*
   (*c*) *qui* to agree with *genera, senatui.*
   (*d*) *totus* to agree with *corporis, nomen.*
   (*e*) *recens* to agree with *injuriarum, re.*

B

5. Translate into Latin:—
   (*a*) Let us not lose our freedom.
   (*b*) Do not hesitate to leave the city.
   (*c*) Broader ships are useful for carrying burdens.
   (*d*) He feared that the enemy might attack your town.
   (*e*) After laying waste their territory he compelled them to give hostages.
   (*f*) They will have no opportunity of asking what you have done.

6. Translate into Latin:—
   (*a*) You have advised the soldiers not to trust the messengers.
   (*b*) If the lieutenant should attack the inhabitants, they would resist him bravely.
   (*c*) We reported that the commander-in-chief intended for many reasons to cross this river.
   (*d*) Learning that the barbarians had returned home, he sent Crassus to pursue them by forced marches.

(*e*) Has he not commanded (use *iubeo*) the enemy to give up their arms within two days?
(*f*) Would that Caesar had not crossed into Britain with all his forces!
(*g*) The camp was so large that it could not easily be fortified by our men on that day.
(*h*) If Caesar is informed of their arrival, he will capture all their baggage.
(*i*) While our infantry were delaying, the Britons began to hurl their weapons.

C

7. Translate into Latin:—

On his arrival there, Caesar found his ships ready to sail. And so, leaving Labienus with three legions and two thousand cavalry to learn what was taking place in Gaul, he himself set sail with the rest of his forces, and on the next day reached Britain. When he had landed his army and chosen a place suitable for his camp, he put Atrius in command of a guard for his ships; and, as soon as he had learned where the enemy had encamped, advancing by night he overtook and put to flight their rearguard. But he commanded (use *impero*) his men not to pursue them too far in their flight, because he wished time to be left for the fortification of his camp.

III

THE RESULTS

The aim of this section of the report is to present, in as clear a method as possible, the results of the tests and examinations. In tables II–XX these results are expressed in the form of frequency distributions. As can easily be seen by an examination of table II a frequency distribution consists of a column of class intervals followed by a column of frequencies. Thus in table II the first column indicates the class intervals used and the second column the number of scores occurring in each class interval. Thus reading from the top table II may be interpreted as follows: 18 pupils have scores on the algebra test of either 49 or 50; 46 pupils have scores of 47 or 48; 111 pupils have scores of 45 or 46, etc. These distributions might have been made giving the number of pupils having each individual score but nothing would be gained and the use of class intervals saves both space and labour.

There are various other things however that we wish to know about the results that are not made clear by the frequency distributions. We would like to know for instance how widely each test or examination distributes the pupils. It is true we have the extreme range. In the algebra test it can easily be seen that the pupils are distributes between 3 and 50. This measure of the spread of a test is not very reliable however as it may give a distorted picture of the spread because of one or two extremely high or extremely low scores. An examination of tables II–XX will show that in each test there is a great increase in the frequencies as we approach the average or centre of the distribution. Thus in table II the greatest frequency comes in the class intervals 33-34. In table III the greatest frequency falls in the class intervals 97-102. What we need first of all is some figure to represent this central tendency. The commonest measure of central tendency is the arithmetic mean or simple average. This measure has the disadvantage of being too much influenced by the extreme scores and it has been found better in most cases to substitute for it the median or the score of the middle pupil in the class, *i.e.*, the score of that pupil who

has the same number of scores above him as below him. If the number of cases is even then the median will be the value midway between the scores of the two middle pupils.

Neither the total range mentioned above, or the median give us any idea of the extent of concentration of scores around the midpoint of the distribution. In order to get a measure of this concentration let us think of the scores as divided into quarters. Table I contains 24 scores arranged in order of merit.

Table I.

98	
96	
93	
92	
91	
90	
———	89.5 Upper Quartile (Q_3)
89	
88	
87	
86	
85	
84	
———	83.5 Median (Mdn.)
83	
82	
81	
80	
79	
78	
———	77.0 Lower Quartile (Q_1)
76	
74	
72	
71	
70	
60	

N = 24 cases

89.5—77 = 12.5 Interquartile Range (I.Q.R.)

If we count from the bottom until we reach the sixth score we will find it to be 76. Midway between this and the next score, *i.e.*, 77 is the point below which are found 25% of the scores. This point is called the lower quartile (Q_1). Continuing our count to the twelfth score we find it comes at 83 and midway between it and the next score *i.e.*, 83.5 is the median (Mdn.) which has twelve scores above it and 12 below. If we continue our count to 18 we obtain 89.5 the upper quartile (Q_3) above which are found 25% of the scores. The distance between Q_3 and Q_1, in this case 12.5 is known as the interquartile range *i.e.*, that part of the range in which lie 50% of the scores. Half of this interquartile range is known as Q or sometimes as the probable error (P.E.).

It is sometimes more helpful to think of distributions as divided into thirds instead of halves or quarters. In this case the standard deviation will be a better measure of the spread or variability of a test. It is the number or value

which differs from the average enough to include one-third of the entire number of cases. This measure is called the standard deviation and its symbol is σ (sigma). [1]Between -1σ *i.e.* one sigma below the mean and $+1\sigma$ *i.e.* one sigma above the mean there lie 68.26% of the cases.

In tables II–XX we have given the number of cases (N), the median (Mdn.), the lower quartile (Q_1), the upper quartile (Q_3) and the interquartile (I.Q.R.). Tables V, VI and VII give the distributions and scores for the three parts of the French tests and table VIII gives the same unformation for a sampling of the whole tests. Tables XII–XX gives the same information for the examinations.

Table II ALGEBRA		Table III CANADIAN HISTORY		Table IV CHEMISTRY	
49-50	18	145-140	2		
47-48	46	139-144	15		
45-46	111	133-138	55	177-184	1
43-44	177	127-132	112	169-176	3
41-42	207	121-126	184	161-168	8
39-40	310	115-120	305	153-160	18
37-38	316	109-114	329	145-152	23
35-36	362	103-108	459	137-144	29
33-34	407	97-102	530	129-136	49
31-32	401	91-96	500	121-128	82
29-30	403	85-90	475	113-120	130
27-28	369	79-84	400	105-112	169
25-26	298	73-78	358	97-104	234
23-24	255	67-72	278	89-96	307
21-22	217	61-66	201	81-88	365
19-20	177	55-60	143	73-80	413
17-18	106	49-54	63	65-72	449
15-16	84	43-48	34	57-64	462
13-14	45	37-42	17	49-56	401
11-12	37	31-36	8	41-48	296
9-10	20	25-30	6	33-40	242
7-8	11	19-24	2	25-32	153
5-6	8	13-18	1	17-24	71
3-4	2	7-12	1	9-16	16
1-2	..	1-6	..	1-8	3
N	4,387		4,478		3,924
Q_1	25.8		79.1		53.2
Mdn	31.8		94.2		70.6
Q_3	47.6		107.3		90.6
I.Q.R	11.8		28.2		37.4

[1](For a more detailed explanation of the terms used above readers are referred to Rugg, A Primer of Graphics and Statistics for Teachers, Houghton Mifflin Company).

Table V FRENCH PART A		Table VI FRENCH PART B		Table VII FRENCH PART C		Table VIII FRENCH COMPLETE TEST	
49-50	1	73-75	2				
47-48	20	70-72	17				
45-46	90	67-69	37				
43-44	213	64-66	93				
41-42	306	61-63	142			146-149	1
39-40	396	58-60	221			142-145	
37-38	406	55-57	268			138-141	4
35-36	363	52-54	300			134-137	5
33-34	336	49-51	382	17		130-133	6
31-32	340	46-48	428	16	10	126-129	8
29-30	238	43-45	363	15	15	122-125	5
27-28	184	40-42	349	14	60	118-121	28
25-26	164	37-39	298	13	81	114-117	21
23-24	77	34-36	213	12	153	110-113	40
21-22	57	31-33	167	11	227	106-109	37
19-20	38	28-30	91	10	294	102-105	44
17-18	26	25-27	59	9	376	98-101	32
15-16	16	22-24	35	8	370	94-97	33
13-14	9	19-21	24	7	352	90-93	19
11-12	8	16-18	10	6	229	86-89	21
9-10	1	13-15	9	5	198	82-85	9
7-8	10	10-12	2	4	79	78-81	13
5-6	8	7-9		3	47	74-77	3
3-4	1	4-6		2	33	70-73	2
1-2		1-3		1	11	66-69	2
N	3,308		3,510		2,535		333
Q_1	30.9		39.7		7.1		95.4
Mdn	35.75		46.9		8.1		104.4
Q_3	40.07		54		10.7		113.6
I.Q.R	9.98		14.3		3.6		18.2

Table IX Geometry		Table X Physics		Table XI Latin	
.....		.....		97-100.....	
.....		.....		93-96.....	
.....		177-180.....		89-92.....	1
.....		169-176.....	2	85-88.....	2
.....		161-168.....	4	81-84.....	7
.....		153-160.....	6	77-80.....	3
.....		145-152.....	19	73-76.....	27
.....		137-144.....	20	69-72.....	44
33-34.....	7	129-136.....	30	65-68.....	80
31-32.....	19	121-128.....	61	61-64.....	102
29-30.....	27	113-120.....	103	57-60.....	128
27-28.....	65	105-112.....	137	53-56.....	173
25-26.....	112	97-104.....	207	49-52.....	189
23-24.....	179	89-96.....	264	45-48.....	218
21-22.....	276	81-88.....	315	41-44.....	259
19-20.....	414	73-80.....	400	37-40.....	255
17-18.....	574	65-72.....	467	33-36.....	289
15-16.....	556	57-64.....	494	29-32.....	289
13-14.....	627	49-56.....	453	25-28.....	238
11-12.....	583	41-48.....	380	21-24.....	202
9-10.....	361	33-40.....	298	17-20.....	190
7-8.....	250	25-32.....	154	13-16.....	117
5-6.....	107	17-24.....	93	9-12.....	86
3-4.....	37	9-16.....	23	5-8.....	66
1-2.....	7	1-8.....	3	1-4.....	19
N.....	4,201	.....	3,933	.....	2,984
Q_1.....	12	.....	49.4	.....	26.1
Mdn.....	15.4	.....	66.2	.....	36.9
Q_3.....	19.2	.....	83.04	.....	49.2
I.Q.R.....	7.2	.....	33.64	.....	23.1

Table XII Algebra	Table XIII Canadian History	Table XIV Chemistry	Table XV French Authors	Table XVI French Composition
97-100.... 76	2	6	..	..
93-96..... 97	12	32	1	5
89-92..... 143	39	74	14	19
85-88..... 179	90	86	43	67
81-84..... 225	158	140	69	107
77-80..... 255	242	228	149	202
73-76..... 322	297	256	208	282
69-72..... 350	355	295	227	280
65-68..... 352	445	268	269	347
61-64..... 392	456	423	247	292
57-60..... 365	442	433	261	202
53-56..... 339	400	351	208	169
49-52..... 279	486	458	191	87
45-48..... 175	171	117	54	90
41-44..... 170	236	170	84	61
37-40..... 145	180	153	72	29
33-36..... 115	98	138	49	22
29-32..... 91	73	75	36	7
25-28..... 66	50	62	24	4
21-24..... 48	36	26	20	4
17-20..... 37	19	22	9	2
13-16..... 28	7	11	9	1
9-12..... 24	3	1	4	..
5-8..... 10	..	1	6	..
1-4..... 2	..	1	5	..
N..... 4,285	4,297	3,827	2,259	2,271
Q_1..... 52.38	50.62	51.68	53.1	57.94
Mdn..... 63.6	60.46	59.84	62.54	66.98
Q_3..... 75.86	70.12	71.58	71.32	74.48
I.Q.R..... 23.48	19.5	19.9	18.22	16.54

Table XVII Geometry		Table XVIII Physics	Table XIX Latin Authors	Table XX Latin Composition
97-100	32	34	1	2
93-96	118	51	17	18
89-92	159	62	31	34
85-88	203	138	80	84
81-84	257	140	121	131
77-80	307	247	160	160
73-76	359	295	198	180
69-72	378	241	245	228
65-68	397	344	277	225
61-64	357	251	292	243
57-60	312	375	283	232
53-56	292	355	296	260
49-52	206	299	302	230
45-48	136	185	107	144
41-44	154	128	92	141
37-40	139	206	114	138
33-36	94	154	91	93
29-32	50	73	77	61
25-28	64	78	49	47
21-24	36	43	34	24
17-20	25	28	21	13
13-16	17	22	26	5
9-12	8	9	10	0
5-8	5	3	5	3
1-4	2	1	1	..
N	4,097	3,762	2,930	2,696
Q_1	54.2	50.1	50.5	49.08
Mdn	66.54	60.16	60.38	60.24
Q_3	77.6	73.36	70.88	71.72
I.Q.R	23.4	23.26	20.38	22.64

In order to facilitate comparisons the quartile scores, the medians and the interquartile ranges are repeated in table XXI.

Table XXI

	Q_1	Median	Q_3	I.Q.R.
Algebra Text	25.8	31.8	37.6	11.8
Algebra Examination	52.38	63.6	75.86	23.48
Canadian History Test	79.1	94.2	107.3	28.2
Canadian History Examination	50.6	60.46	70.12	19.5
Chemistry Test	53.2	70.6	90.6	37.4
Chemistry Examination	51.68	59.84	71.58	19.9
French Test	95.4	104.4	113.6	18.2
French Authors Examination	53.1	62.54	71.32	18.2
French Composition Examination	57.94	66.98	74.48	16.54
Geometry Test	12	15.4	19.2	7.2
Geometry Examination	54.2	66.54	77.6	23.4
Latin Test	26.1	36.9	49.2	23.1
Latin Authors Examination	50.5	60.38	70.88	20.38
Latin Composition Examination	49.08	60.24	71.72	22.64
Physics Test	49.4	66.2	83.04	33.64
Physics Examination	50.1	60.16	73.36	23.26

In order that the results in tables II–XX may be compared graphically figures 1-14 have been prepared in which the results of the test and the corresponding examination have been given in adjacent figures.

The results of the tests are shown in the odd figures while the even figures contain the results of the examinations. In the case of French and Latin the authors and composition examinations have been shown on the same figure.

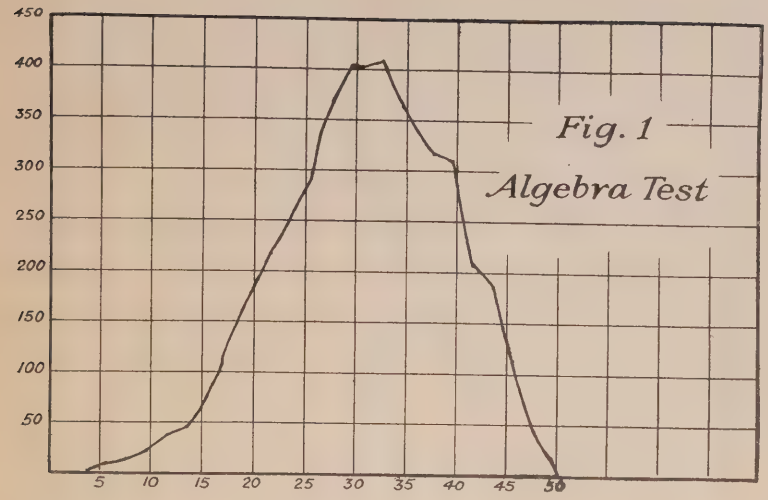

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Fig. 1
Algebra Test

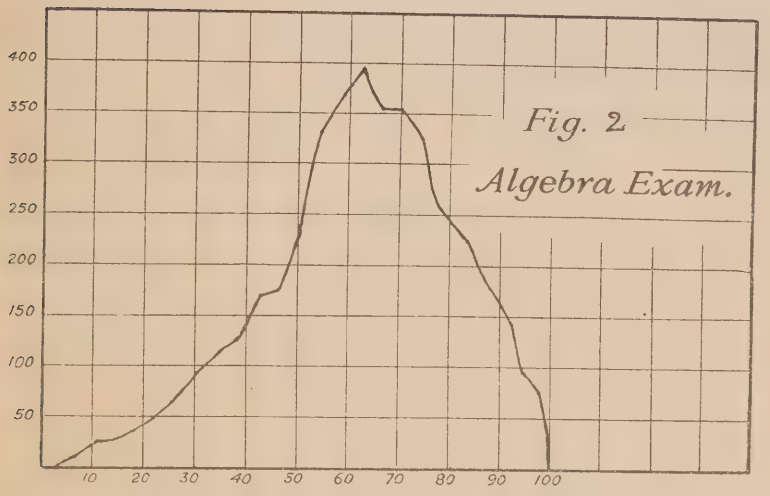
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Fig. 2
Algebra Exam.

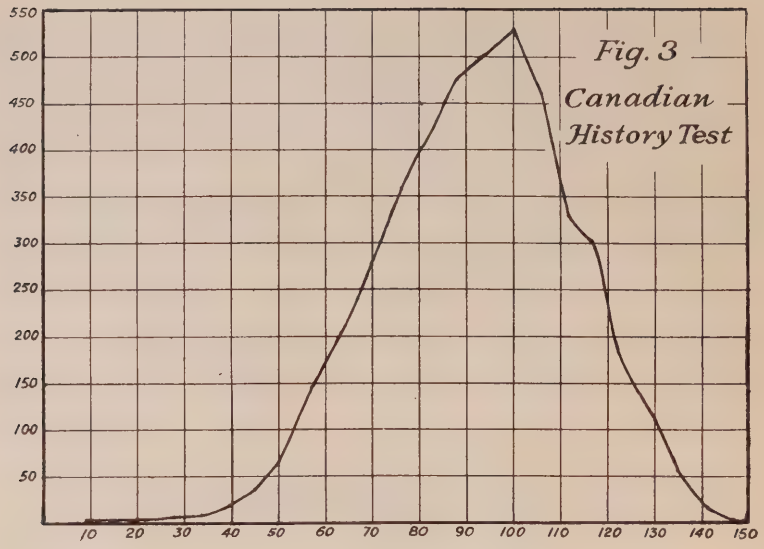
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Fig. 3
Canadian
History Test

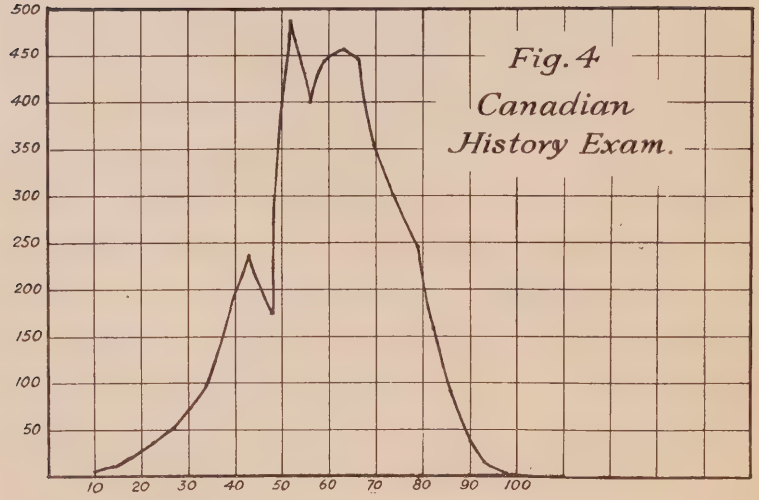
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Fig. 4
Canadian
History Exam.

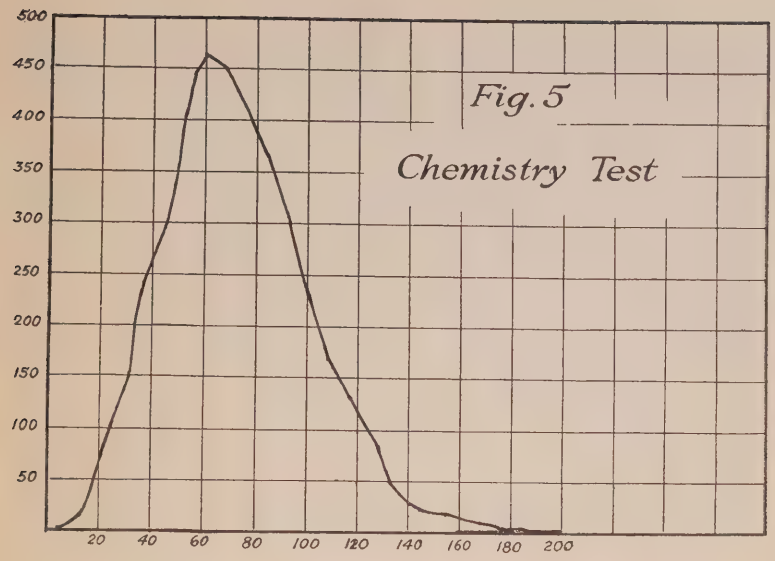
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Fig. 5
Chemistry Test

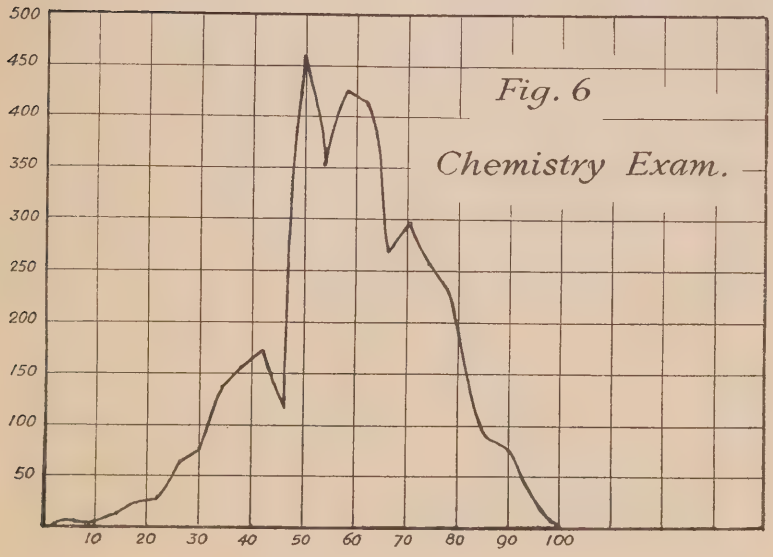
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Fig. 6
Chemistry Exam.

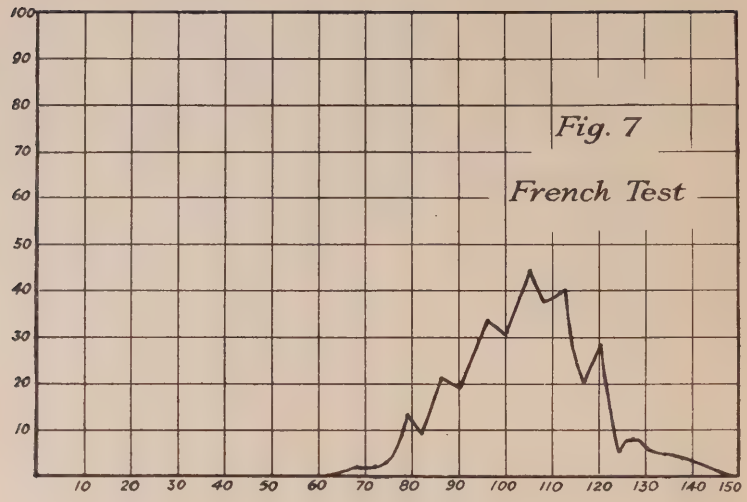
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Fig. 7
French Test

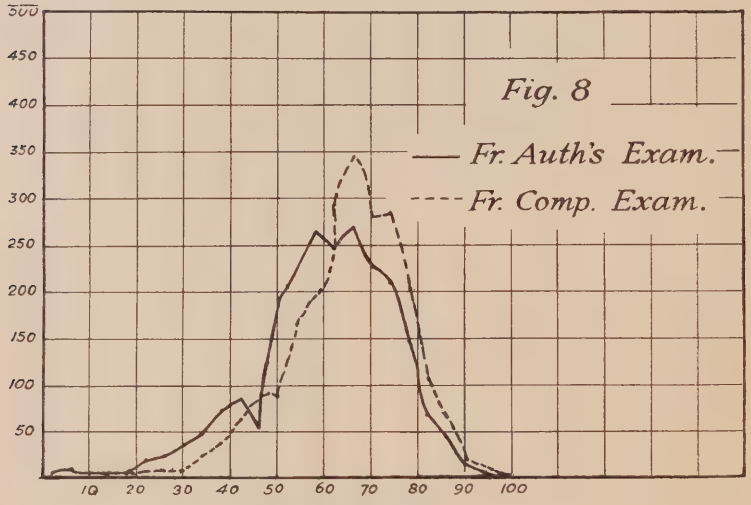
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Fig. 8
Fr. Auth's Exam.
Fr. Comp. Exam.

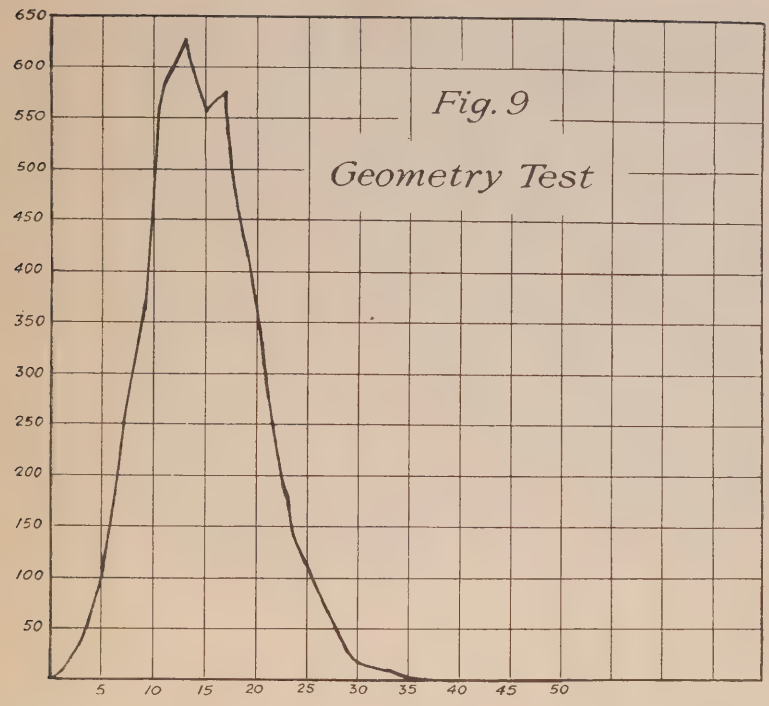
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Fig. 9
Geometry Test

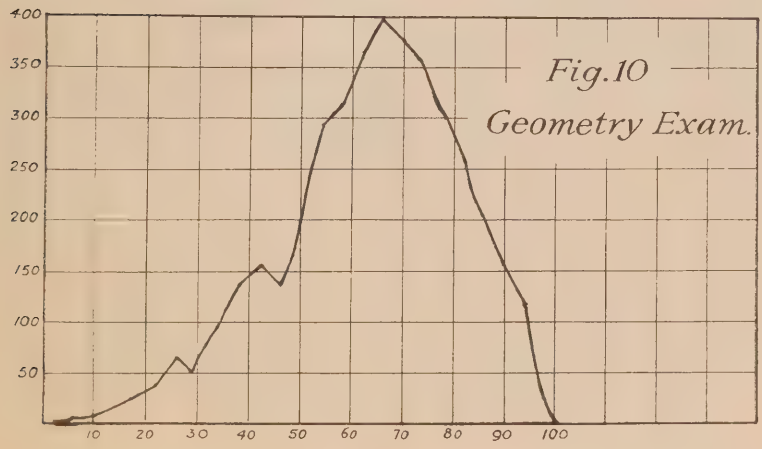
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Fig. 10
Geometry Exam.

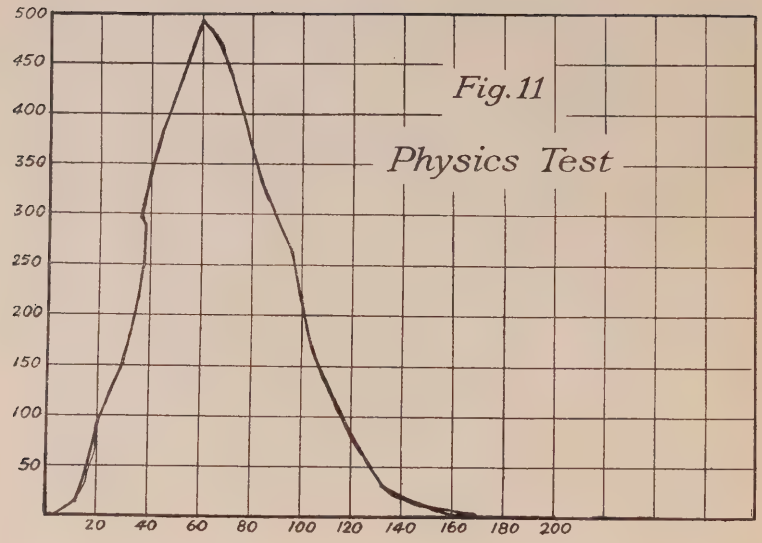

Fig. 11

Physics Test

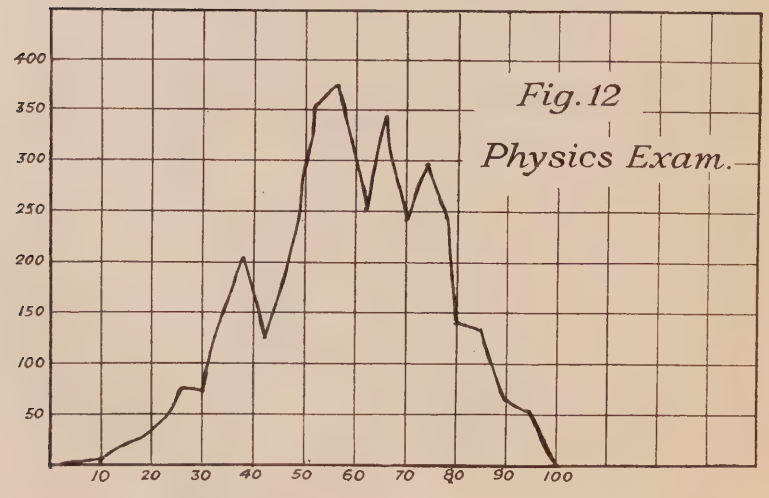

Fig. 12

Physics Exam.

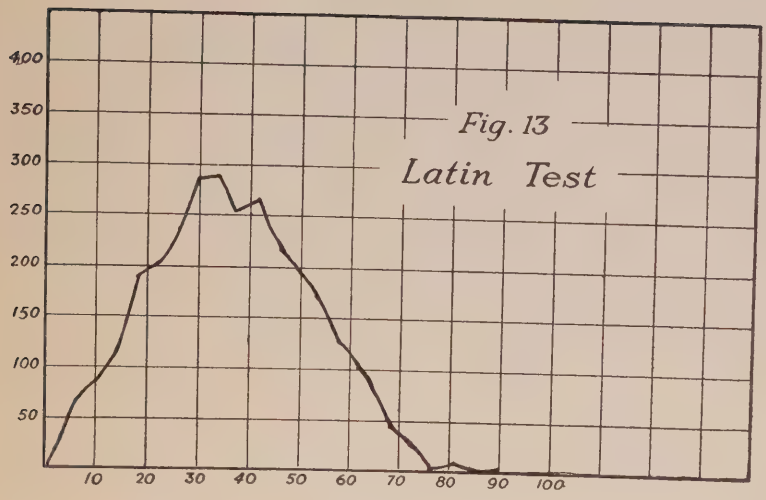
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Fig. 13
Latin Test

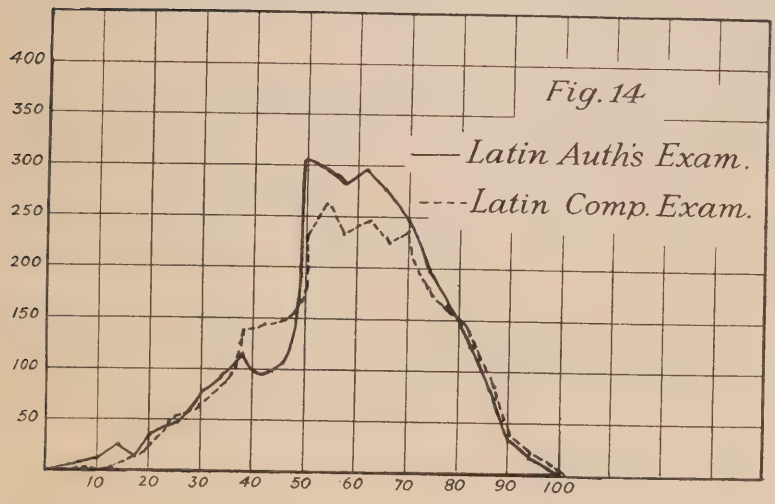
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Fig. 14
Latin Auth's Exam.
Latin Comp. Exam.

IV

RELIABILITY

Reliability of a test may be defined as the degree of consistency with which it measures what it actually does measure or the degree to which it is consistent with itself in measuring the same thing two or more times.

The most direct way to find the reliability or consistency of a test is to administer two equivalent forms to the same students under approximately the same conditions and then calculate the correlation between the two sets of scores. It is easy to see that, if we had an ideal test, in two absolutely equivalent forms, the student who received 75 on the first form would receive 75 on the second form, the one who received 60 on the first would receive 60 on the second and so on down the list. This would represent perfect correlation which is expressed by 1.00. If there were absolutely no relation between the scores on the two forms the correlation would be zero. Between these two limits we may have varying relations indicated by such coefficients as .30, .60, .90, etc. Thus the reliability of a test or examination may be measured in terms of the correlation between the scores on the two forms of the test. This is the reliability coefficient of the test and is known as r_{12} (read r one two).

This procedure of giving two equivalent forms of a test or examination is often not feasible as the test may exist in only one form. In this case a method very commonly used consists in splitting the test into halves, making up one set of scores from the even numbered items and another set from the odd numbered items. In this way the student receives two scores. The correlation between the two sets of scores is calculated in the usual way and the resulting coefficient known as $r_{\frac{1}{2}\frac{1}{2}}$ (read r one-half one-half) indicates the reliability of a test one-half the length of the original test. Since[1] reliability bears a constant and known relation to the length of a test it is possible to calculate the reliability of the whole test by means of the Spearman-Brown formula.

It must be remembered however that the reliability coefficient is a generalized and unanalyzed measure which tells little or nothing about the margin of error in the score of an individual pupil. Nor is the reliability coefficient a satisfactory measure of reliability for the purpose of comparing one test with another for it is affected by the distribution, in the trait measured, of the particular group studied. A reliability coefficient of .40 from a group of pupils in a single grade may quite well indicate a greater degree of reliability than a coefficient of .90 obtained from a group composed of children from the second to the twelfth grade.

In view of the inadequacy of the reliability coefficient alone as evidence of the reliability of the test the following information has been given in the case of each test and examination:

(1) The reliabiliity coefficients $r_{\frac{1}{2}\frac{1}{2}}$ and r_{12}.
(2) The standard deviation (as a measure of the range of talent).
(3) The mean (median) score.
(4) The number of cases used (N).

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[1](For a more detailed explanation of the various methods of calculating the reliability of tests and examinations see Ruch and Stoddard, Tests and Measurements in High School Instruction, World Book Co., pp. 355-362.)

These data will permit of the calculation of almost every statistical measure needed in critical test evaluation.

There are also a number of methods of expressing the amount of error present in an individual score. Two of these are (a) the probable error of a raw score or the probable error of measurement ($P.E._M$) and (b) the probable error of an estimated true score ($P.E._{\infty 1}$.).

The raw score on a test or examination is the obtained point-score *i.e.*, the mark given the pupil after the correction of the test. The true score is a hypothetical concept. It represents the average score made by a pupil on an infinite number of equivalent tests.

The probable errors indicate the deviations in any set of scores from the theoretical true scores.

The magnitude of the $P.E._M$ assumes significance only when it is compared with the magnitude of the measures from which it is calculated. A $P.E._M$ of 2 represents a much more serious error for a score of 10 where it is 20% of the score than it does for a score of 40 where it is 5% of the score. A simple method of making this comparison consists in the use of the [1]ratio $\frac{PE_M}{median}$ which expresses the probable error of measurement as a percentage of the average score.

A less variable [2]ratio $\frac{PE_{\infty I}}{\sigma}$ has been suggested by Kelley as a means of comparing the reliability or the fallibility of tests. This expresses the probable error of the estimated true score as a percentage of the standard deviation (σ), or, in other words gives its relationship to the range or variability of the test. Let us suppose that this ratio in a given test is .15. This means that the chances are even that any estimated true score does not differ from the true score by more than $.15\sigma$ or 15% of the standard deviation of the test. Also the chances are 4:1 that the estimated true score does not differ from the true score by more than 2 ($.15\sigma$) or $.30\sigma$. The chances against the error being as great as 3 ($.15\delta$) or $.45\sigma$ are about 20:1[3].

Table XXII contains the following data for each of the tests and examinations:

(1) $r_{\frac{1}{2}\frac{1}{2}}$ (reliability coefficient of the half test or examination).
(2) r_{12} (reliability coefficient for whole test or examination).
(3) Ruch and Stoddart, Tests and Measurements in High School Instruction, p. 374.)
(4) σ (standard deviation).
(5) Mean (in this case the median).
(6) P.E.M.
(7) Ratio of the P.E.M to the median score.
(8) $P.E._{\infty 1}$.
(9) Ratio of the $P.E._{\infty 1}$ to the standard deviation.
(10) N (number of cases).

Of these items number 8, the ratio of the probable error of an estimated true score to the standard deviation seems to be the most significant for the comparison of tests scaled to different units.

([1]Monroe, Introduction to the Theory of Educational Measurements, p. 215.)

([2]Statistical Method, pp. 214-216.)

([3]Ruch and Stoddard, Tests and Measurements in High School Instruction, p. 27).

In the interpretation of this ratio Ruch and Stoddard suggest the following standards:

"Ratios from .10 to .19 are highly satisfactory indicating a sufficiently reliable test for individual measurement or diagnosis.

"Ratios from .20 to .29 are fairly satisfactory indicating that the tests have some value for individual diagnosis.

"Ratios from .30 to .39 are not satisfactory for individual diagnosis but can be used with confidence for purposes of class measurement."

Table XXII

	$r_{\frac{1}{2}\frac{1}{2}}$	r_{12}	σ	Mdn.	P.E.$_M$	P.E.$_M$ / Mdn.	P.E.$_{\infty 1}$	P.E.$_{\infty 1}$ / σ	N
Algebra Test...	.78	.83	8.12	31.8	2.05	.064	1.79	.22	4,387
" Exam..	.38	.55	18.64	63.6	8.42	.132	6.15	.33	4,285
Can. Hist. Test.	.75	.85	20.4	94.2	5.19	.055	4.91	.23	4,478
" " Exam.	.38	.55	14.44	60.46	6.03	.099	4.28	.30	4,297
Chem. Test....	.84	.91	28	70.6	5.63	.079	5.36	.19	3,924
" Exam...	.59	.74	15.76	59.84	5.67	.095	4.78	.30	3,827
Geom. Test....	.76	.86	5.36	15.4	1.5	.097	1.26	.24	4,201
" Exam...	.56	.71	17.64	66.54	6.3	.096	5.35	.30	4,097
Physics Test....	.82	.90	26.56	66.2	5.51	.083	5.37	.20	3,933
" Exam...	.56	.71	17.4	60.16	6.2	.103	5.26	.30	3,762
French Test....	.72	.83	14.01	104.4	4.78	.045	3.49	.24	333
" Authors Ex.	.61	.75	14.88	62.54	5.02	.080	4.32	.29	2,259
" Comp. Ex..	.73	.84	13.12	66.98	3.54	.052	3.19	.24	2,271
Latin Test.....	.66	.79	15.96	36.9	4.84	.131	4.38	.27	2,984
" Authors Ex.	.64	.78	16.48	60.38	5.11	.084	4.55	.28	2,930
" Comp. Ex..	.86	.92	16.24	60.24	3.06	.051	2.96	.18	2,696

In our comparison of the reliability of the tests and examinations we will omit the French and Latin and consider them later. There are two reasons for this: first, in the case of the French and the Latin we are comparing one comprehensive test with two examinations; second, in the case of the Latin the test is not really a new-type examination but merely a 3-hour old-type paper, to be compared with two 2½ hour old-type papers.

If we examine first the coefficients of correlation we find for the tests coefficients ranging from .83 to .91 while for the examinations the coefficients range from .55 to .74. In other words the highest reliability coefficients for the examinations is .09 lower than the lowest coefficient of the tests. This is a startling difference when one remembers that the tests are not standardized but merely informal objective tests. However as we have already indicated direct comparisons of coefficients of correlation are apt to be misleading. For this reason in order to render direct numerical comparison valid we will transmute the coefficients of correlation into coefficients of alienation in which numerical differences are always equal to real differences in degrees of relationship. The coefficient of alienation[1] (known as k) is the ratio of an error of estimate to the error of pure chance; that is, it tells us how nearly the scores of a test approximate a pure chance relationship to the scores on another test. A high coefficient of alienation[2] therefore means a close approximation to chance while a low coefficient of alienation means a small error.

In table XXIII we give the coefficients of alienation for the examinations and for the tests.

Table XXIII

	Algebra	Canadian History	Chemistry	Geometry	Physics
Exam.....	.835	.835	.672	.704	.704
Test.....	.557	.526	.414	.510	.435
ratio $\frac{\text{Exam.}}{\text{Test}}$	1.62	1.58	1.62	1.38	1.62

The general conclusion from these figures is that the tests are approximately one and a half times as reliable as the examinations. It is well to remember that the tests used here do not at all represent the limit of reliability that can be attained by the new-type examination. Wood in his New York experiment using standardized tests instead of informal objective tests as used here, found the tests from one and a half to two and a quarter times as reliable as the old-type examinations.

Let us now turn to the ratio $\frac{PE\infty I}{\sigma}$ which interprets the error of the estimated true score as a percentage of the range of the test. For the examinations these ratios run from .30 to .33 which, according to the interpretation of

([1]Kelley, Statistical Method, p. 173).

([2]Wood, New Type Modern Language Tests, p. 117).

these ratios given by Ruch and Stoddard, would indicate that, while these examinations may have considerable value for group measurement or comparison of classes they possess little or no value for individual measurement.

Let us examine the tests from the same point of view. Their ratios run from .19 to .24. According to the same interpretation it may be said that they are exceedingly reliable for group measurement and possess considerable value for the measurement of the individual. One of the tests, Chemistry, even falls below .20 which places it in the class of those tests which are highly satisfactory for individual measurement. Tests with ratios up to .24 are approaching the point where the value for individual diagnosis is high.

If we examine the ratio $\frac{\text{PE}_{\text{M}}}{\text{median}}$ we find that the facts tend to strengthen the conclusions already reached. In only one case, Geometry, do we find the ratios the same for both the tests and the examination.

Let us now examine the facts for the French. In this case as has been stated above, we are comparing a single comprehensive test with two old type examinations. The two examinations taken together require five hours or twice the time required for the test. If we compare the test with the individual examinations we find that it greatly surpasses the authors examination in reliability and is approximately equal to the composition examination. The reliability of the examination as a whole *i.e.*, the five hour examination is probably slightly higher than that of the two hour and a half tests. The critical ratio in the case of the examination would probably be about .21 or .22. It must be remembered however that the French test proved quite unsatisfactory. The technique employed in part I is quite unsuited for an examination on prescribed texts. There is not the slightest doubt that by careful standardization a test of this technique could be produced with a critical ratio of .15. The critical ratio for the modern language tests employed by Wood in his New York experiment runs even lower than .15. In other words it is possible to produce a single standardized test of two hours and a half that would have a greater reliability than two old-type examinations.

In the case of the Latin as has been said the test is a test in name only. In only one part, question 4, is a technique employed which at all resembles the technique of the new-type examinations. Again as in the case of French we are comparing a single examination with two examinations. In this case the single examination is of the old type and requires three hours while the two examinations require five hours. The correlation coefficient for this examination is .79 as against .78 for Latin authors and .92 for Latin composition. The critical ratio is .27 as compared with .28 for Latin authors and .18 for Latin compositions.

The ratio for the two old-type papers combined would probably be about .20 compared with .28 for the single paper. From this we may conclude that one cannot, by the use of the old-type technique, construct a single two and a half or three hour examination that will be as reliable as two old-type papers.

Validity.

So far we have been comparing the tests and the examinations from the standpoint of reliability or accuracy of measurement. Important as is the reliability of a test there is another quality quite as important and very much more difficult to determine namely validity. Validity may be defined as the degree to which a test or examination measures what it is claimed to measure. It is easy enough to determine by the distribution of marks whether an examina-

tion measures but it is not so easy to determine whether it measures achievement in the subject that is being measured.

Various methods of determining the validity of tests are used and among these one of the commonest is the correlation of the test scores with the school marks. Another method is the correlation of the test scores with some other well known measure of school success. In the present case we will compare the validity of the tests and the examinations by correlating the scores of each with the school marks. Table XXIV contains the correlation for all subjects except Latin. In the case of French the test was correlated with the average of the teachers' marks in authors and composition and the average of the two examinations was correlated with the average of the teachers' marks.

Table XXIV

	Algebra	Canadian History	Chemistry	French	Geometry	Physics
Test and Teach. Mark	.63	.59	.53	.65	.52	.60
Exam and Teach. Mark	.71	.44	.57	.70	.60	.62

In examining these correlations two points must be kept in mind: first, the low reliability of school [1]marks which range between .50 and .75; second, the fact that school marks depend partly on a number of term examinations, which examinations are of the old-type.

The low reliability of school marks make high correlations impossible. It can be shown that, if school marks are no more reliable than .50 to .75, the highest possible correlation of a reliable test with such marks cannot exceed .70 to .85. We must therefore compare these correlations coefficients with .70 to .85 rather than with 1.00.

The fact that teachers use old-type examinations in determining marks will necessarily tend to make the examinations correlate more closely with these marks than do the tests. In spite of this, however, the figures in table XXIV show that the tests correlate almost as closely with the teachers' marks as do the examinations. In other words if we are to take school marks as a criterion the tests are almost if not quite as valid as the examinations.

If we assume a certain validity for the examinations an assumption that has certainly been made in the past we may also test the validity of the tests by correlating their scores with those of the examinations. Table XXV gives the correlations between the tests and the examinations. In the case of French the average mark on the two examinations is used.

TABLE XXV

Algebra	Can. History	Chemistry	French	Geometry	Physics
.67 (.67)	.62 (.68)	.72 (.82)	.66 (.77)	.63 (.78)	.68 (.85)

([1]Ruch and Stoddard, Tests and Measurements in High School Instruction, p. 318).

The figures in parentheses represent the highest possible correlation that can be expected with the known reliability of the tests and examinations. These correlations are high enough to conclude that the tests are valid if the examinations are. Indeed, if we compare these correlations with the reliability coefficients of the examinations in Table XXI we will see that the results of the examinations correlate almost as highly with the tests as they would with another old-type examination.

VI

Cost

There remains the question of the comparative costs of the tests and examinations. Several comparisons of this kind have already been made. Wood in his New York experiment showed that the cost of scoring or marking the new-type papers is about one-tenth of the cost of marking the old-type papers. In this experiment certain comparisons of this kind are possible.

The average number of papers read by each examiner in one day in each of the subjects of the following Middle School Departmental examinations is:

Algebra	18
Canadian History	12
Chemistry	17
French Authors	14
French Composition	17
Geometry	16
Latin Authors	16
Latin Composition	18
Physics	13

This gives an average of 15.6 papers per day for each examiner. This makes approximately 76 cents for reading each paper.

The clerks reading the new-type papers or tests averaged over the entire period 94.4 tests per day or approximately 13 cents a test for reading. These figures cover merely reading the papers and tests and take no account of other expenses. The making of standardized tests would undoubtedly cost more than ordinary examinations but this extra cost would be small compared with the enormous expenses of reading the papers. On the whole a conservative estimate would put the cost of the new examination at about one-fifth of the old-type examination.

VII

Conclusions

1. The tests used in this experiment although not standardized but merely informal objective tests using new-type technique have proved to be considerably more reliable than the old-type examinations and to possess more value for individual measurement.

2. As regards validity their correlation with the school marks shows that they are almost if not quite as valid as the examinations.

3. This conclusion as regards validity is confirmed by the correlation of the test results with the results of the examinations.

4. It seems certain that a single test employing new-type technique can be constructed that is more reliable and quite as valid as two old-type examinations in a foreign language.

5. A single old-type examination is not a good substitute either from the standpoint of reliability or validity for two old-type examinations in a foreign language.

6. As regards cost of reading it is quite evident that the tests can be read for approximately one-fifth of what it costs to read the old-type examinations. This is a very conservative estimate.

VIII

Teachers who received new-type tests for their schools were asked to send to the department their comments on these new-type examinations. It was originally intended that the present report should contain a summary of these comments for each of the tests. Upon examination, however, these comments were found to be so numerous as to make it impossible to deal with them in this report. For that reason teachers are referred to the following texts which deal exhaustively with all points connected with the new-type tests.

Rugg, A Primer of Graphics and Statistics for Teachers, Houghton Mifflin Company.

Ruch and Stoddard, Tests and Measurements in High School Instruction, World Book Company.

Kelley, Interpretation of Educational Measurements, World Book Company.